BRIEFING
Wednesday, 21 October 1970
0930 Hours

1. Corporate Briefing (Structure etc.) [redacted] 25X1

2. Free Radical Mechanisms
   Duplicating, Laser and Camera Speed

3. PH 2000 Film Materials and Systems [redacted] 25X1

4. Questions, Discussions and Samples

25 yrs old - 46
12 " - inventions
of FR.
Jan 69 — public —
Horizons Res.
4 Divisions
1.
2. Metal pho 25X1
3. Photo Horizons
mfg of ...
Camera 4. Ph 5 depts.
Cameras

PROJECT 333

[redacted]

Mechanisms

Project Progress and Systems

Questions, Discussions.

[redacted] 25X1

25X1

[redacted]

25X1

[redacted]

25X1

[redacted] HEAT FIXER, MODEL HIF-3

Description

The [redacted] Heat Fixer, Model HIF-3, is a laboratory sheet heat fixer intended for use with [redacted] free-radical Type 2000 duplicating films. The fixer gives uniform heat fixing of 4 x 6 inch precut sheets of film. Accurate and reliable control of the air temperature is provided by a solid state proportional temperature control. Before the fixer is shipped it has been preset to 160°C. The controller is capable of holding 160°C $\pm$2°C. 25X1 25X1

The fixer, packaged in an attractive wood grained case, has an integral activated charcoal filter provided for trapping the effluent, which is produced during the fixing process. This equipment is well construced, safe, reliable in design and provides a convenient method for processing exposed 4 x 6 inch sheets of duplicating films.

Specifications

18

Size:	15" x 15" x 22"
Weight:	40 lbs.
Maximum Film Size:	4" x 6"
Power Required:	120 VAC, 10 Amps
Warm-up Time to Stabilize Temperature:	15 Minutes
Web Fixing Uniformity:	At a flash density of .8 $\pm$.03 density unit.
Film Holding:	An attached film holder and tray, with end holding strips. It is required that the operator position the ends of the film under the strips and allow the film to be processed sensitized side up!
Fixing Times:	1 Minute to 3 Minutes is considered normal range.
Safety:	The electrical design conformed to the good practices of the underwriters laboratory specifications.
Shipping:	The fixer is shipped in a special fibre carton which provides safety for the device during shipment.
Cost:	Price on request. [redacted]

25X1

SENSITOMETRY - FREE RADICAL PROCESS

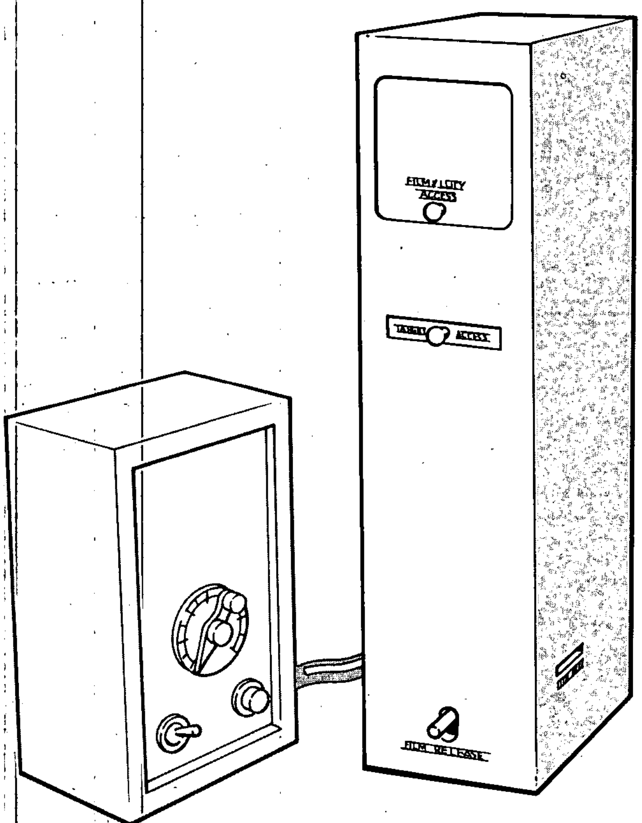
Photosensitivity (D=1.0)	1 mw-sec/cm^2	Spectral Response	3500-4600Å (pk 4200)
Gamma Control	Optical Development Time/Temp.	Gamma Range	0.6 - 2.6
Shelf Life (40^o F)	3-5 months	Useful log E range (γ = 1.0)	>1.8
		D max	2.0
		D min	0.1
Temperature Stability (100^o F)	Unknown	Aging Effects	Sensitivity Loss
Element Size	15Å (.0015 μ)	Structure	Dye-Molecular
Visual Color	Brown-Blue	Density (Type)	Visual Diffuse
Reprint Capability	Contact, projection	Spectral Absorption	4000 - 8500Å (gap at 4800 Å)
System Application	Direct D.P.	Resolution Capability	Printer/Proc. limited
Storage Environment Effects	Density loss, severe conditions	Storage Life	No known problems
		Base	5 mil polyester
		Sub	0.1 μ adhesive
Sensitometry	Attractive possibilities for gamma control. Improvements in system repeatability required.	Coating	Solvent Type
		Coating Thickness	8-12 μ
		Durability	Equal to or better than Ag gelatin
Image Characteristics	Inherently high resolution. Better color balance and better uniformity required	Thermal Stability	Polyester limited (150^oF)
		Chemical Resistance	Good, cleanable
		Physical Characteristics	Basically good in film structural design, if coating problems are solved.
Processing System	Completely dry. Processor design not yet possible.	System Technology	Photosystem design and formulation requires much scientific R&D prior to further attempts at process system design

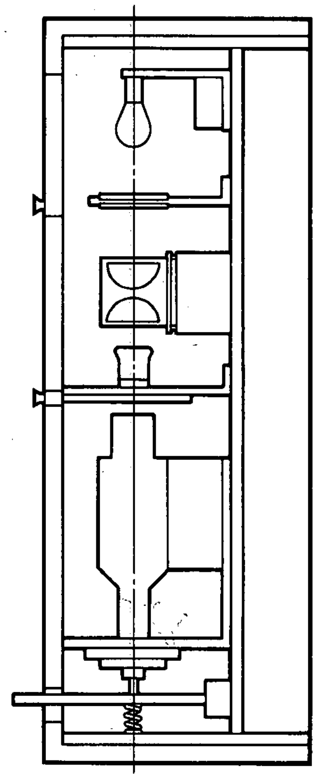
Conclusions

Inherent characteristics of the Free-Radical system appear very attractive. It is not clear that [redacted] can apply the R&D capability required to bring this effort to a timely fruition. 25X1

25X1

PRELIMINARY SPECIFICATIONS





HIGH INTENSITY MICRO CAMERA MODEL HIM-2

25X1

- **High Intensity**
- **Up to 70mm wide**
- **Interchangeable Targets and filtration**
- **Compact 7″ x 5″ x 20″**
- **Simple to operate**

HIGH INTENSITY MICRO CAMERA

The [redacted] high intensity microcamera is a very compact highly precision microcamera providing a high intensity image on films up to 70mm wide and any running length. The instrument permits the interchangeability of targets and filtration systems in a very compact easy to use system. Designed primarily for [redacted] Free Radical Film, it can be used on any photo-sensitive material. The high intensity illumination is provided by a specially designed 13.5 Volt, square filament lamp. The light from which is collected and collimated through a condensing system, and a field lens. The field lens illuminates the target which is at the correct focal distance from the microscope objective for the proper magnification ratio. The objective is a Vickers .5 numerical aperture, 20X lens, designed for use without cover slip. The aerial image resolution measured at the film plane approximates the theoretical capability of the lens which is 2400 cycles/mm in blue light.

The film sample is placed in an opening on the side of the microcamera, capable of accepting films up to 70mm wide and any length. The film is held in the film plane by a spring loaded platen. The target of appropriate configuration and contrast is placed in the target holder in the front of the machine. Any filters required are placed in the filter drawer. The microcamera has the capability of adjusting the focal distance of the lens for a through focus series, but can also be locked in a fixed position for routine work of the same film material. The desired exposure time is set on the timer and the exposure begun. It automatically returns to the original time setting.

The machine was designed specifically for [redacted] Free Radical Films and repeatable day to day resolutions of 1600 cycles/mm are obtained. The exposure times from 30 to 60 seconds are normal for this material. Operation with silver halide materials will require the use of a neutral density filter in the filter drawer so as to reduce the total illumination at the film plane.

For optimum results the microcamera is designed to be operated in a dark room where the temperature and humidity is controlled and where there is some form of vibration isolation system. The microcamera is completely packaged in two durable cases, one holding the timer and transformer, the other holding the microcamera itself.

SPECIFICATIONS

25X1

Film Input	Any type of photosensitive material, any length up to 70mm in width
Optics	Vickers 20X .5 N.A., without cover slip
Condensers	Two 55mm focal length, plano convex 32mm diameter lenses
Field Lens	One Vickers 10X complan wide field ocular
Targets	Any target capable of being placed on a 2x2x⅛″ transparent material with the desire target placed in the center having a usable diameter of 10mm
Resolutions at the Film Plane	2400 cycles/mm aerial image as measured with a 600X oil immersion objective
Power	115 Volts AC, 60 HZ, single phase regulated current
Dimensions	2 Boxes Approx. 6x7x21″ and 7x10x4″
Price	[redacted], Continental USA
Delivery Date	60 days from date of order. Check out and calibration service at Customer's location. Price on request.
USAF 1951 Resolution Targets	Metallic deposition on glass, silver film on glass available in high, medium or low contrast. 2″x2″x1⁄16″—$200. Special targets available on request. Instruction Manual is included.

25X1 25X1 25X1

Although not necessary it is recommended that the customer avail himself of the check out and calibration service at the location by [redacted] personnel. 25X1

[redacted] reserves the right to alter the design or construction of the equipment described provided that in [redacted] opinion such alteration in no way affects the performance or specifications presented herein. 25X1 25X1

Price subject to change without notice.

[redacted] 25X1

[redacted] 25X1

PRICE LIST

MILITARY SYSTEMS DEPARTMENT

[redacted] 25X1

HIM-2 MICRO CAMERA

[redacted] 25X1

A high intensity camera intended for resolution measurements and/or producing micro images on silver, [redacted] or 25X1 other nonconventional film materials. Compact, reliable and easy to operate.

HIS-3 SENSITOMETER - PRINTER

[redacted] 25X1

A highly controlled exposing device suitable for controlled sensitometric exposures, or duplication onto 4" x 6" sheets of [redacted] films. 25X1

HIF-3 FIXER

[redacted] 25X1

Compact 4" x 6" sheet fixer. Very uniform processing. Companion piece to HIS-3 Sensitometer-Printer. Includes integral charcoal filter and solid state temperature controller.

HIP-2 PRINTER MODIFICATION KIT

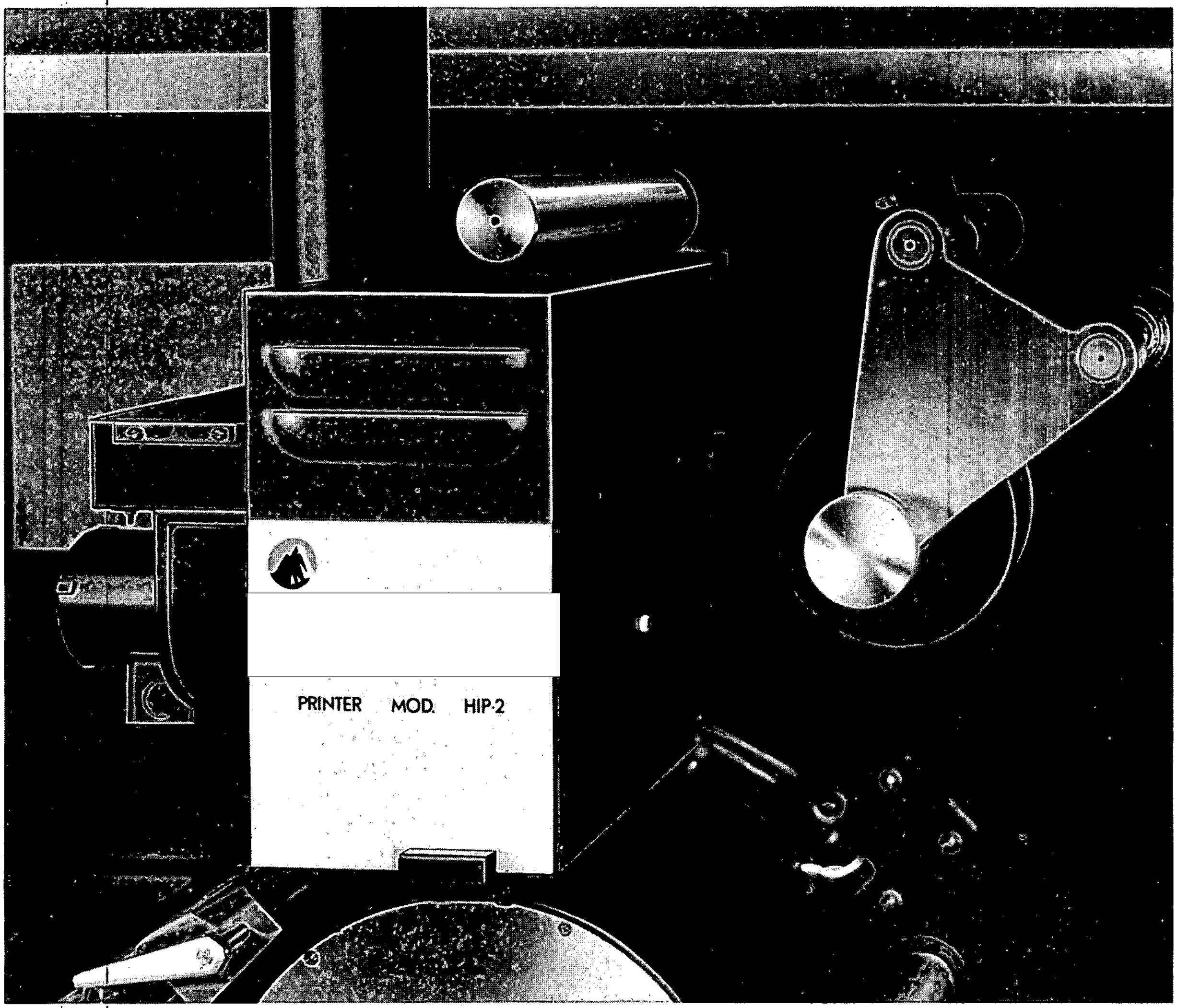
[redacted] 25X1

A high resolution modification kit for existing Niagara wide film printers. Ease of installation and removal. No major changes in original printer. Provides up to 50 ft./min. printing capability with [redacted] Type 2000 duplicating films. Up to 25X1 5" wide webs can be printed.

Suitable lease or rentals available on above equipment.

[redacted] 25X1

 25X1



25X1

PRINTER MODIFICATION KIT MODEL HIP-2

- ☐ **Print 70mm or 5" wide rolls of Type 2000 Duplicating Films** 25X1
- ☐ **Convert existing military 1-008-E-001 printers**
- ☐ **Simple conversion and removal**
- ☐ **Low cost**
- ☐ **High resolution**
- ☐ **Variable speed 0 to 50 feet per minute**

PRINTER MODIFICATION KIT MODEL HIP-2

Th[redacted] Printer Modification Kit Model, HIP-2 provides a convenient method for converting existing Model, 1-008-E-001 continuous roll to roll photographic duplicators to handle [redacted] Type 2000 dry, non-silver, high resolution duplicating film.

The conversion includes installation of two 1000 watt doped mercury arc tubes in the lower portion of the existing light source cavity, replacement of the drum drive with a variable speed (zero to 50 feet/minute) drive system, additional cooling blower and support controls. The heat generated by the mercury sources is removed by a secondary blower installed on the side of the source cavity. If desired, the exit air can be vented with piping to the outside to prevent heat build-up in the room. The printing drum operates at a nominal 75 to 80°F and no sensitometric effects are experienced on the Type 2000 material at this temperature. No major changes are made in either the existing electrical logic or source printing capability. Changing back to silver printing capability consists of removal of the conversion.

Extensive testing on a modified printer and Type 2000 duplicating material combination has shown an unusually high output resolution. Typical results from standard USAF 1951 three bar targets on 3414 film, are as follows:

T.O.C.	Original Target*	Duplication Material
	3414 Type film positive target resolution	Type 2000 negative resolution transfer
1.6:1	115 cycles Horizontal 115 cycles Vertical	115 cycles Horizontal 115 cycles Vertical
3.47:1	203 cycles Horizontal 181 cycles Vertical	203 cycles Horizontal 181 cycles Vertical

*In relation to rotation of printing drum; Horizontal is parallel to drum rotation, Vertical is perpendicular to drum rotation.

The operation of the modified printer is straight forward: the printing sources are started, 15 minutes is required for the lamps to stabilize, Type 2000 film, 70 mm or 5 inches is positioned and the original negative roll installed on the printer. The printing rate is selected depending on the negative density input. When the lamps have stabilized, the operator starts the drive and take up reels and continuous printing occurs until the entire original roll has been duplicated. It is then taken to a heat fixer separate from the printer, where it is finally processed.

modified printer specifications

FILM TYPE	[redacted] TYPE 2000 Duplicating films, any lengths up to 5" in width
PRINTER TRANSPORT RATE	Up to 50 feet per minute
POWER	110 Volts 40 amps
DIMENSIONS	Fits Existing Printer
SOURCE	Two 1000 watt doped mercury arc tubes
OPTICS	None
COOLING	A blower is provided to cool the source cavity, achieving printing drum temperatures of 75°F to 80°F.
RESOLUTION TRANSFER	Under ideal conditions with a 3414 original target T.O.C. 1.6:1 115 cycles input, the output is 115 cycles on Type 2000 film. The transfer is correspondingly higher with higher input contrast targets.
SAFETY	All wiring and controls are properly grounded and follow best commercial practices. The lamps have a high U.V. output and therefore are properly shielded to prevent operator injury. A safety mask is provided for working on the **open** cavity. Suitable caution labels are provided.
FIXER	Fixers are available from various sources.
PRICE	PRICE ON REQUEST 60 days from date of order. Installation, check out and calibration service at Customer's location. Price on request.

25X1
25X1
25X1

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Price subject to change without notice.

[redacted] 25X1

[redacted] 25X1

[redacted] 25X1

[redacted] SENSITOMETER, MODEL HIS-3 25X1

Description

The HIS-3 Sensitometer is used for controlled exposures of [redacted] free-radical film type 2000. It has been designed particularly for this film and uses a long life, 400 watt Mercury light source with its primary radiation in the region of maximum film sensitivity. A folded optics light path allows uniform illumination of a 4 x 6 inch format in a small total overall package size. The exposure is controlled by an adjustable 0 to 10 minute timer, allowing duplicate use as a sensitometer and a contact printer. The unit contains its own lamp ballasts. For optimum results the unit should be coupled with a voltage regulator. 25X1

Specifications

Size: 23" x 15" x 20"

Weight: 50 lbs.

Maximum Film Size: 4" x 6"

Power Requirements: 100 Volts 5 Amps

Calibration: 50 millijoule/cm^2

Optional Voltage Equipment Available on Request.

Cost: Price on request [redacted] 25X1

RED-LITE DEVELOPMENT OF LATENT IMAGES

[redacted] 25X1

1. [redacted] free-radical photographic systems have the unique advantage that the latent image can be developed by blanketting the film with red or infrared radiation. This development, which can be compared to solution development of conventional silver films, makes free-radical films stand out among all the other high resolution, molecular image films. Because unconventional, nonsilver films usually yield one or less dye molecules for each absorbed photon, they achieve high resolution only at the cost of speed. Only by finding a means of development can these films be both high resolution and truly fast. Other organic chain reaction photo systems, which have reported quantum efficiencies greater than 100, are in effect developed by the chain reaction that is initiated by the first image photon. This development is usually directly proportional to instability because the energy for development is stored in the film. Red-lite development of free-radical films does not relate to instability because the development energy is stored externally. The multiplying reaction in the free-radical case is essentially turned on and turned off when the red light is turned on and turned off. 25X1

2. Red-lite development is a photochemical reaction. As such it is a reaction that responds to a very selective wavelength. Perhaps a number of you are not chemists. Therefore, I will simply describe photochemistry by comparing it to thermally initiated reactions and reactions that take place in the presence of catalysts. Thermally initiated reactions are non-selective. The heat added to the reactants will activate the molecules in a variety of ways which can cause side reactions and low yields. Catalysts make the reaction more specific and enable the reactions to take place at lower temperatures. Photochemical reactions are the most selective of all. Reactions that might have required a thousand degrees F are possible with photochemistry. Red-lite development then is a relatively clean chemical reaction.

3. Temperature does have its effects on red-lite development. In practice there is an optimum temperature for development of each of our film systems. They have usually been between room temperature and 60°C. The effect of temperature on red-lite development is a subject that deserves a paper in itself. Some in-depth work was done in the past by Richard Fotland when he learned to control γ with temperature. Since application of heat itself does not cause development, the uniformity of temperature in the heat fixing step is not nearly as critical for our film as it is for those film systems that use heat for development.

4. This paper is about the dramatic advancements made in the understanding of red-lite development at a practical level and the considerable advancement in the technology of building red-lite units. The most dramatic improvements in red-lite technology have evolved from the study and improvement of the radiation sources. We have learned that fine tuning the color cut-on of the radiation is a valuable tool for increasing film speed. The signal to noise ratio of the desired wavebands vs fogging wavebands has been improved by orders of magnitude. With the use of interference filters we have been better able to identify the actinic wavebands and it has led us to new routes for red-lite processor design. Double development, which has been already described, is another significant improvement in red-lite technology.

SLIDE 1 Title

SLIDE 2

Red-lite development is illustrated here as the second step in [redacted] higher speed free-radical photo process. A blue 25X1 image photon can yield one dye molecule. A blanket exposure with the selected wavelength can cause this one dye molecule to yield many dye molecules. In this illustration I show an amplification of five, where in practice we see factors of 10,000 routinely. The yellow balls represent the dye precursors which tend to be more sensitive in the blue. The small green balls represent the activator with which the dye precursors react to yield dye. In the last step, fixing removes the unused activator. Fixing can be done by the use of heat (in other words dry) or with a solution.

SLIDE 3

The development mechanism as postulated on a Jablonski diagram is illustrated here and was explained in detail in [redacted] 25X1
[redacted] paper. 25X1

SLIDE 4

Greater detail of the postulated mechanism appears in this illustration which was previously published in the Journal of Photographic Science. The singlet/triplet energy levels of the dye are represented on the left and the singlet/triplet levels of the complex are illustrated on the right. Development begins with the absorption by the dye of a selected red wavelength photon. This raises the dye to the singlet level which rapidly decays to the metastable triplet level. This diagram illustrates the fact that in a total system the population of each energy level actually has a spread of values. In this case we show the peak of the population of the dye triplet state to overlap the lower energy tail of the triplet level of the complex. Although the peak of the triplet level of the complex is shown to lie above the peak of the triplet level of the dye, the intersystem crossing can occur without going up hill. Once in the triplet state, the complex can react chemically to yield more dye molecules.

SLIDE 5

This slide illustrates the relation of optimum development color to the spectral sensitivity of the film and to the absorption peak of the image dye. Optimum development, as illustrated here, represents the highest photographic speed. We can determine this rather precisely now with narrow band-pass filters. For a single dye system the optimum development typically occurs 50 to 150 nm to the long wavelength side of the dye absorption peak. The development is tied to the absorption peak because without absorption the photon cannot effect development. The tail of the spectral sensitivity curve causes the development optimum to occur to the right of the absorption peak. Optimum development therefore is a compromise between maximum absorption and minimum fogging. Considerable improvements have been made in the last few years by improving the purity of the film ingredients. Anything, such as purification, which reduces the spectral sensitivity tail allows development to continue further before the maximum allowable fog is attained. Radiation to the longer wavelength side of the optimum is also detrimental. In this region the effective development is so slow that thermally initiated fog does not permit the maximum development.

SLIDE 6

I will now refer briefly to two slides from [redacted] 25X1
paper to emphasize the significance of red-lite development. The first one on speed and the second on information content help illustrate that [redacted] free-radical films have broken 25X1
out of the traditional tie between resolution and speed. We have proven that resolution does not necessarily have to suffer because of high speed. The difference between the yellow and the yellow and black dotted curves is caused simply by the amount of red-lite development. The higher speed characteristic curve, which is to the left, received more red-lite development, and as a result is 100 times faster than the moderately developed film. Note that the characteristic curves are the same. There has been no change in D_{max}, D_{net} or γ.

SLIDE 7

The solid yellow line shows that the fully developed film can achieve resolution over 1300 line pairs/mm and also have an AIM curve that permits an extremely high amount of information content. The question had been put to me some years ago that resolution would have to suffer because of the spreading spherical effect when the 10,000 or more dye molecules are generated around the original latent dye molecule. Because the relatively large dye molecule is smaller than 10 Ångstroms in diameter, 10,000 can fit into a sphere with the cross section that is too small to be measured by 4,000 Ångstrom light.

SLIDE 8

One of the keys to optimum development is fine tuning the cut-on of the development radiation. This is illustrated in a slide from [redacted] talk on the styryl system. The required exposure can be reduced from 155 ergs/cm^2 to 23 ergs/cm^2 by changing the cut-on from approximately 610 to 660 nm. Double development is also illustrated here by using the proper sequence and amounts of the two extreme cut-ons. The effectiveness of fine tuning the color cut-on as a tool for increasing speed was very dramatically shown by developing a step tablet with one slow pass under the aperture while the color cut-on is slowly changing. The cross-over region from fog to development was roughly a half inch. At the speed used, this represented a color cut-on change of about 1 Ångstrom.

25X1

SLIDE 9

I will now discuss several types of red-lite development units. The radiation characteristics are shown on the slide. They are absolute measurements and the curves are directly comparable. The shape of the curves were measured with a Beckman DK-2 Radiometer using the lead sulfide detector, which is fairly flat over this region. The absolute intensities were measured out to .8 microns with a Gamma Scientific Radiometer. Except for the small black spike in the lower left corner, all these units had a 2030 filter. The 3,000 Watt Quartzline lamp had a water filter in addition to the 2030. As you can see, a high percent of its output is in the nontarget region beyond .8 microns. The use of dichroic filters instead of the water filter to dump the heat enabled the use of a 650 Watt SunGun. The result was higher intensities in the target waveband and considerably lower IR output. This was a significant break-through because it enabled the use of the fragile Wratten gelatin filters. With this set of closely spaced filters we were able to make the fine tuning necessary for achieving even higher speeds. An additional improvement was made by using a Marc 300 Indium Tri-iodide arc source instead of the SunGun. The result was higher intensities in the waveband without an increase in the IR region. In addition, the energy efficiency was higher. The Marc 300 is a more precisely made lamp which enabled a better uniformity at the film plane. More recently we have achieved development with the radiation let through a narrow bandpass filter. This has been very significant in that equal development has been achieved with some films in equal time with the energy under that curve as compared to the energy under any one of the other curves. This fact has led us to the design of newer development units using light emitting diodes or gas discharge lamps that have a narrow band output. The area under the curve of the 3,000 watt unit is 214 mw/cm^2 at film plane as measured with a thermopile. The 650 watt SunGun produces 80 mw/cm^2. The Marc 300 unit delivers 100 mw/cm^2. The use of an interference filter instead of a 2030 filter with these dichroic units yields only 2 mw/cm^2. The efficiency of the energy necessary for development has thereby been increased about 100 fold.

SLIDE 10

The use of a 100 Watt Tungsten lamp illustrates how simple red-lite development can be. Note the white paper. This can be used to effectively double the intensity. When possible, that is, when the intensities are high enough, a black surface under the film is preferable to prevent extra development in the low density areas. This tends to flatten out the D Log E curve and lowers the effective speed.

SLIDE 11

This is typical of the water filter units. A Corning Glass 2600 filter which was especially useful for some film formulations, had to be placed in the water to prevent it from cracking under the intense radiation from the lamp. A moving platen was used to effectively smear out the one dimensional uniformity of the line source into two dimensions. The design of platens has been improved to include control of temperature to $\pm\frac{1}{2}^{\circ}F$ over the 3" x 4" format.

SLIDE 12

This is a photo of one of the original dichroic units with the film platen in position under the unit's aperture. The lamp is located in the housing on top. The two dichroic filters at 45° angles are located in a tunnel in the bottom of the unit. The hole on the right side is the exhaust port for the cooling fan. The black platen rests directly under the 1" x 2" aperture. The control box on the left is for the speed and oscillation of the platen. The tube going off to the left on the platen is for the vacuum hold down of the film. There are also ports in the platen for heating elements when used for temperature control.

SLIDE 13

Here the unit is shown diagrametrically. The two shortwave pass dichroics allow the visible and far IR to be transmitted, reflecting only the desired 200 nm band. The filters at the exit aperture determine the cut-on. The internal 2030 filter was originally put in to prevent light spillage through the tunnel.

SLIDE 14

The HID-1 was designed and built to be a research tool and to provide the engineering data necessary for the design of the next generation of red-lite development units. The Marc 300 with one dichroic filter is housed in the black box in the left middle section of the photo. Just below it is the black temperature-controlled platen and the Uni-slide and motor. The uniformity of the light at the platen surface has been measured to within ±1% over the 1¼" x 1" aperture. The lamp is relatively stable. Its operation is monitored by the voltmeter and ammeter located above it. The intensity is monitored via a fiber optic probe placed in the Uni-slide and read out on a solid state radiometer, which can be seen on top of the unit in the upper left hand corner. The platen, which has been anodized black, is temperature controlled over a range from 40°F to 140°F with a Frigid-heat unit located below. The uniformity of the platen surface is within 1°F. The YSI Teletherm in the lower right hand corner monitors the temperature in the platen and at other selected locations. The platen movement has a variable control. The control logic of the platen's movements is coupled to the shutter logic. An environmental cover was made to fit on top of the platen to allow experiments with stagnant and variable gas flows. It also can be used for tests under a variety of atmospheres.

As a result of surveying the US marketplace and of responses to my requests for proposals, we have anticipated future customer needs. In particular, high speed, wide format film processors will be needed and there may be a need for airborne and shipborne processing. I hope the responses to my RFP's are more numerous in the future because of the special set of papers tonight.

SLIDE 15

This slide shows the profile of the output of a proposed sodium lamp which would operate at 672 Watts and would yield, after collection and filtration, 4 Watts/cm^2 at the plane for a 40 cm^2 format.

SLIDE 16

Perhaps the most interesting approach, for which I solicited proposals, uses light emitting diodes. For airborne and ship-borne uses, where compactness and reliability are most important, they seem to have a distinct advantage. They appear to be a good match for our film. Their light output is similar to the transmission through a narrow bandpass filter. They tend to be Lambertion emitters, which is a perfect compliment to a film which is a cosine receptor. With today's state-of-the-art, they can be arrayed to yield intensities comparable to our existing units with the same overall efficiencies. Since it is a rapidly advancing technology, considerably improved possibilities are expected next year. They bring with them the standard solid state features of long life, reliability, and compactness.

SLIDE 17

This is an experimental array put together at [redacted] 25X1
[redacted] While the packing density was not great in this 25X1
case, the intensities were sufficient to develop our first films with them. They are placed very close to the film and have a spectral aluminum collar to effect an infinite, extended source. The uniformity is relatively good because each diode overlaps many of its neighbors, even at these short lamp-to-film distances. This approach has some exciting possibilities, as does the whole topic of red-lite development of [redacted] 25X1
free-radical films.

RED-LITE DEVELOPMENT

OF FREE-RADICAL LATENT IMAGES

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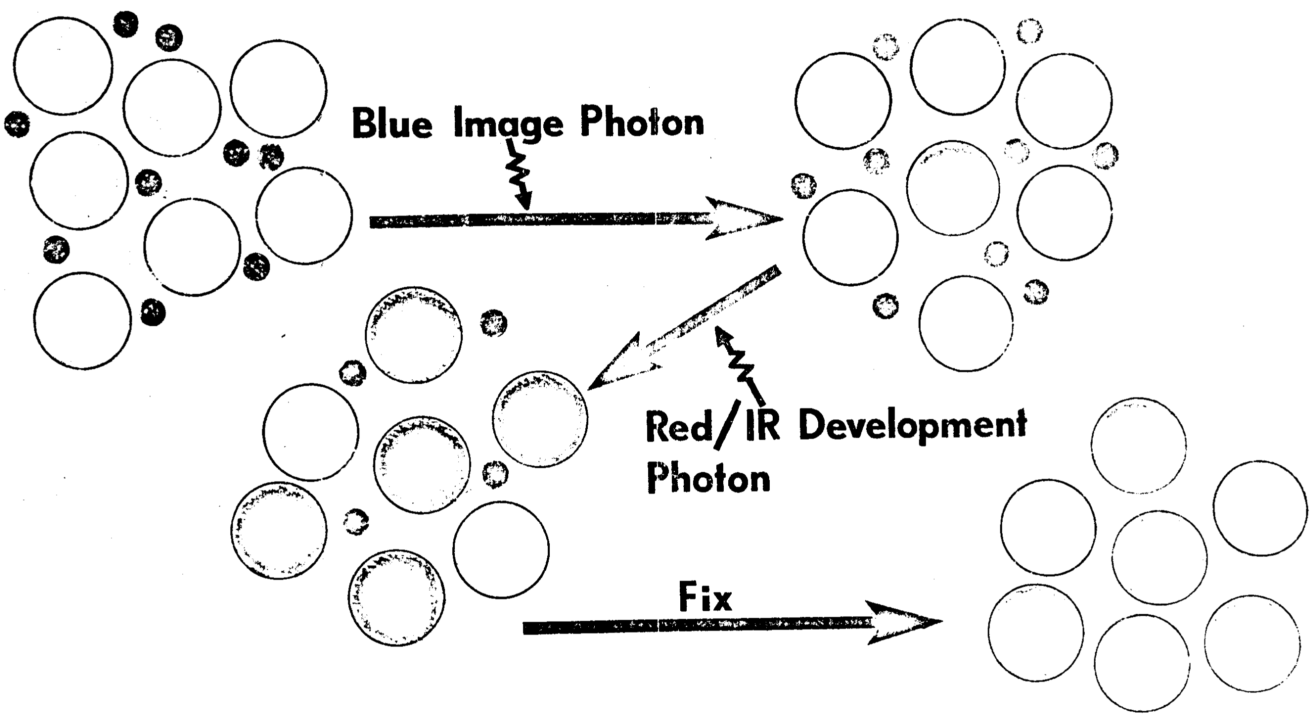
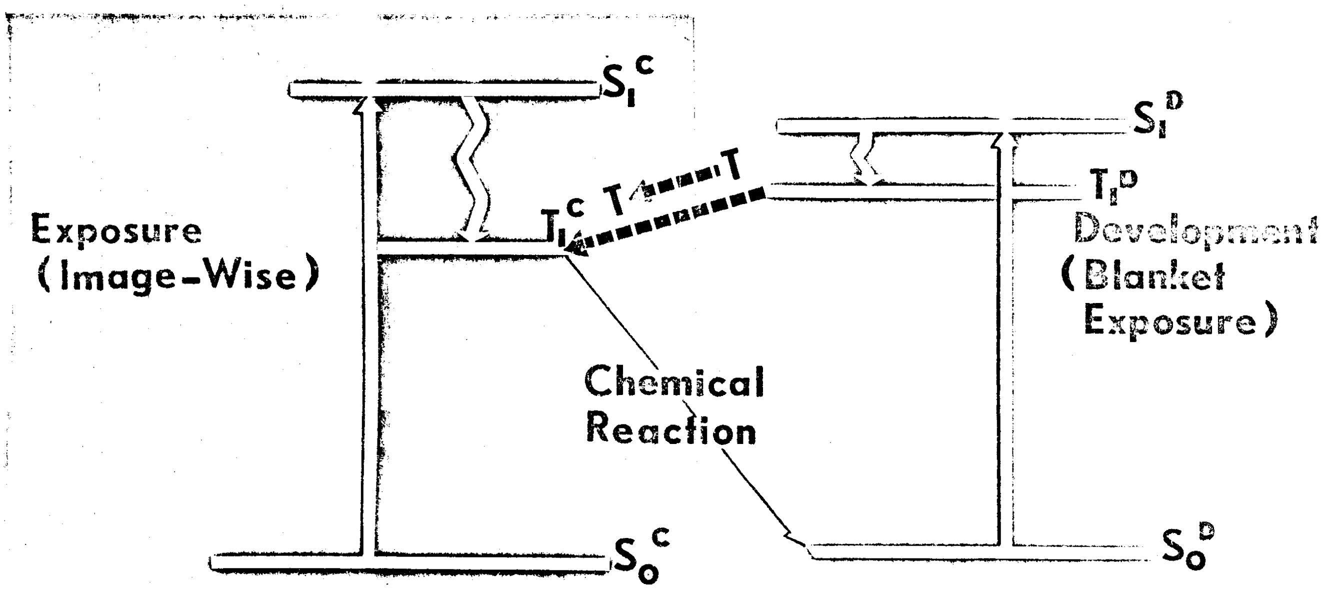
FREE-RADICAL PHOTO PROCESS
INCLUDING DEVELOPMENT



SECONDARY PHOTOCHEMICAL REACTION

OPTICAL DEVELOPMENT PROCESS

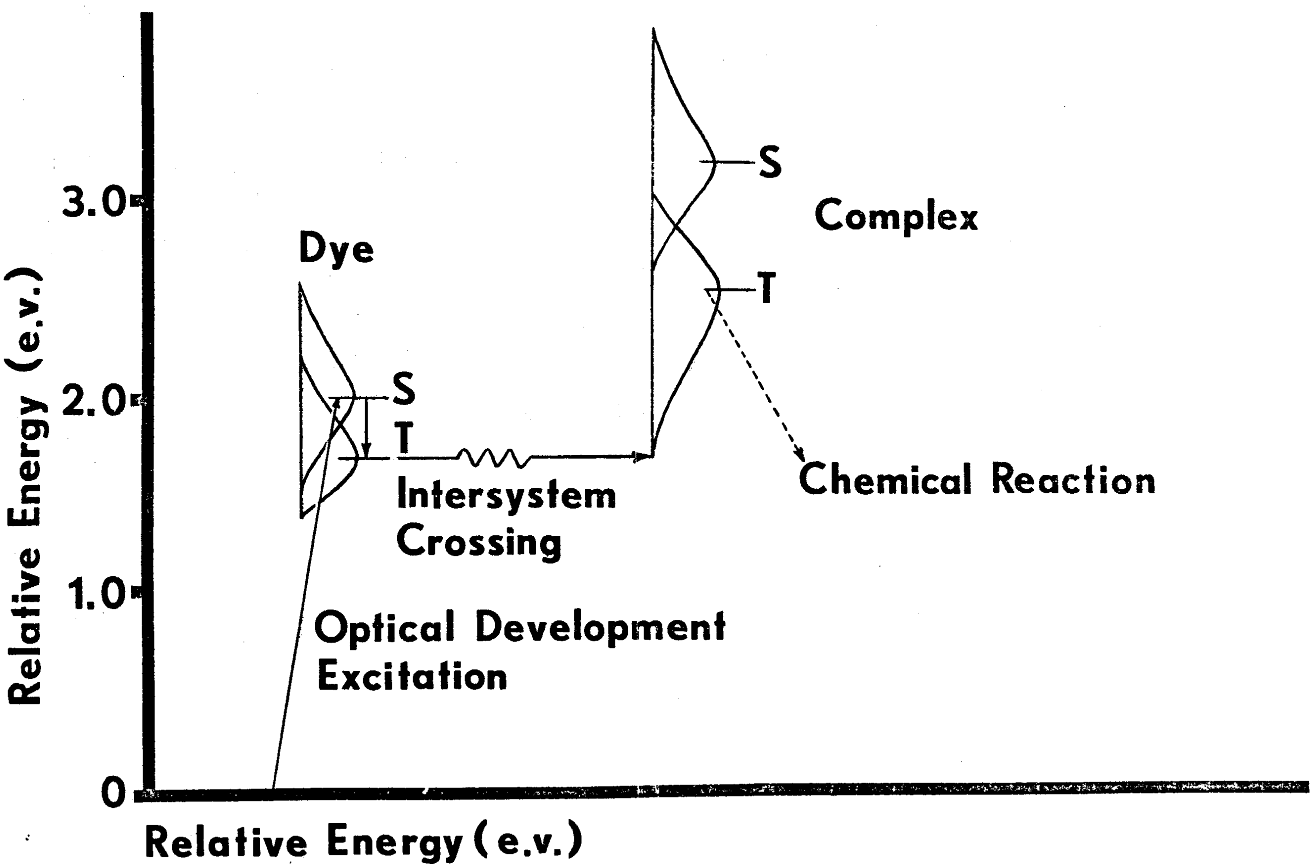


Photosensitive Complex

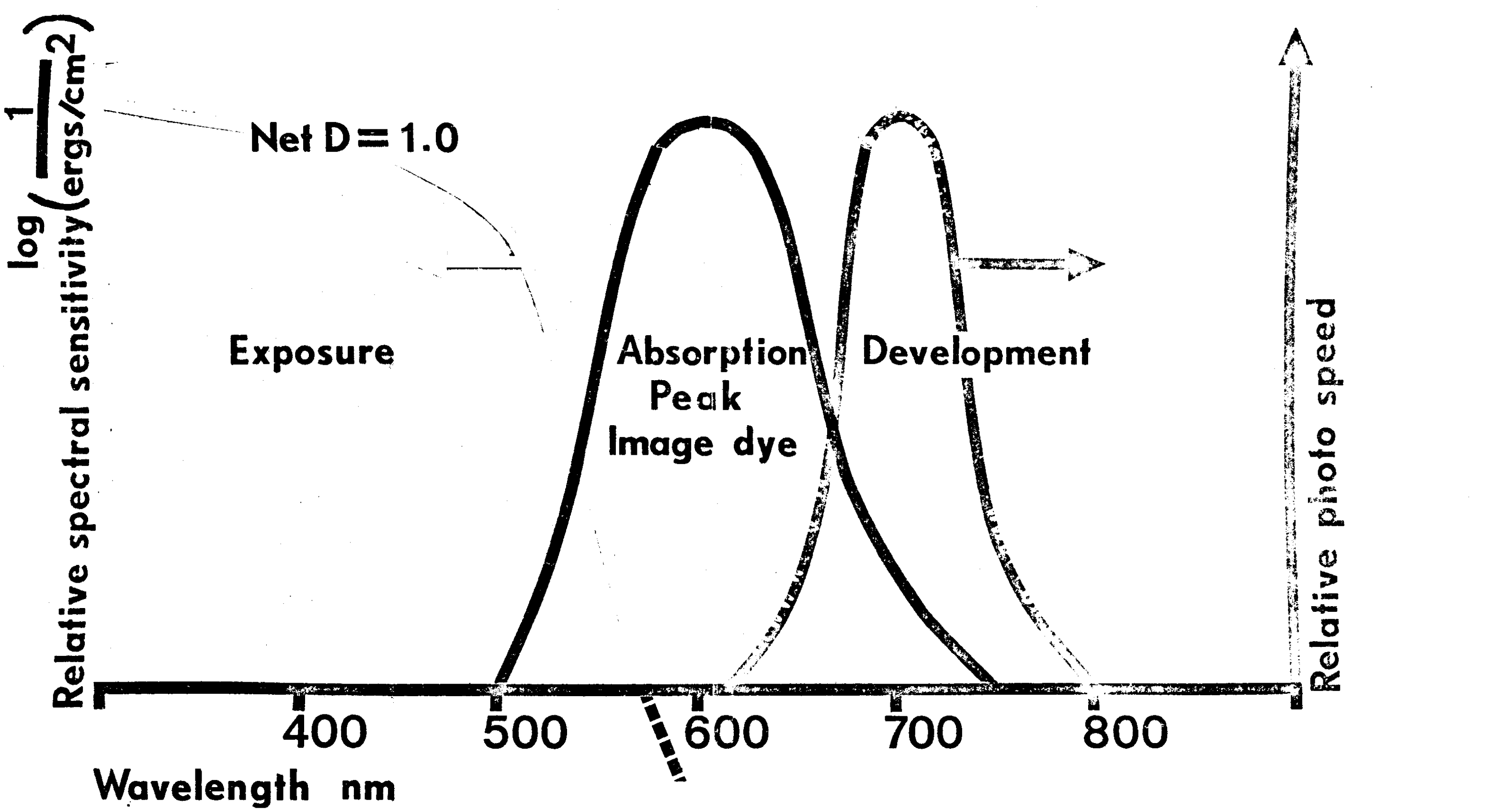
Photogenerated Dye

RED LITE DEVELOPMENT

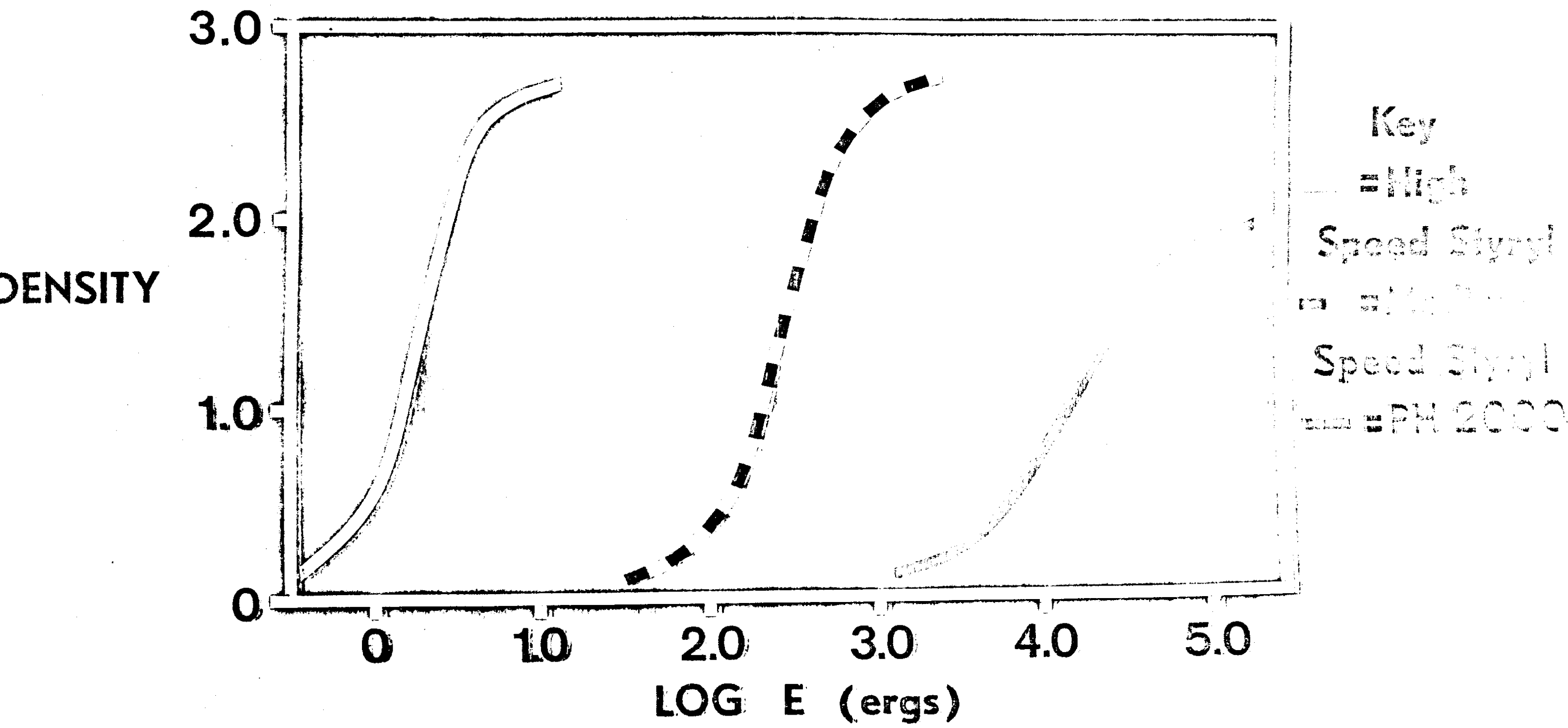
ENERGY LEVEL DIAGRAM



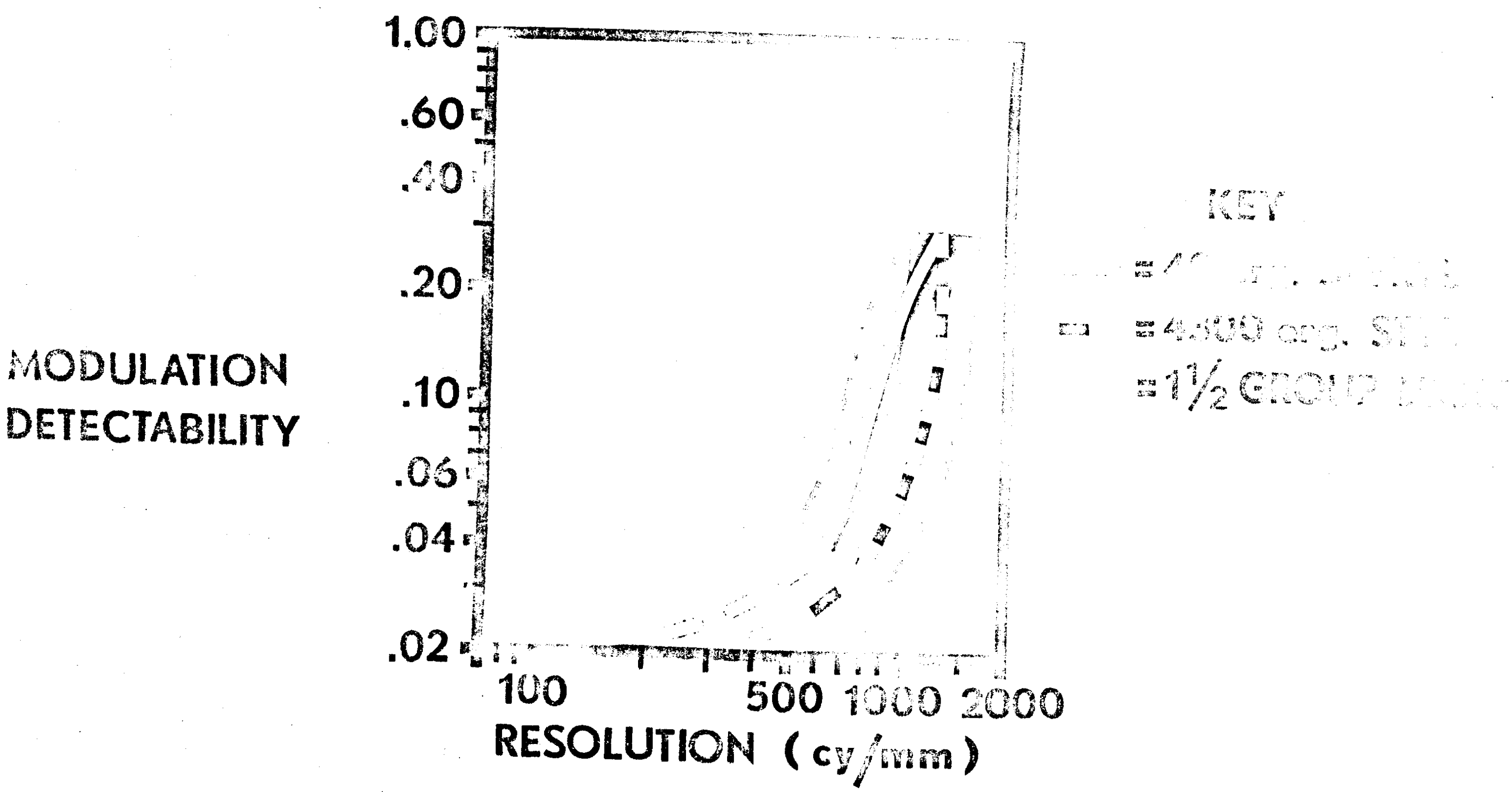
SENSITIVITY · ABSORPTION · DEVELOPMENT



RELATIVE FILM SPEED



AIM CURVES OF LASER FILMS



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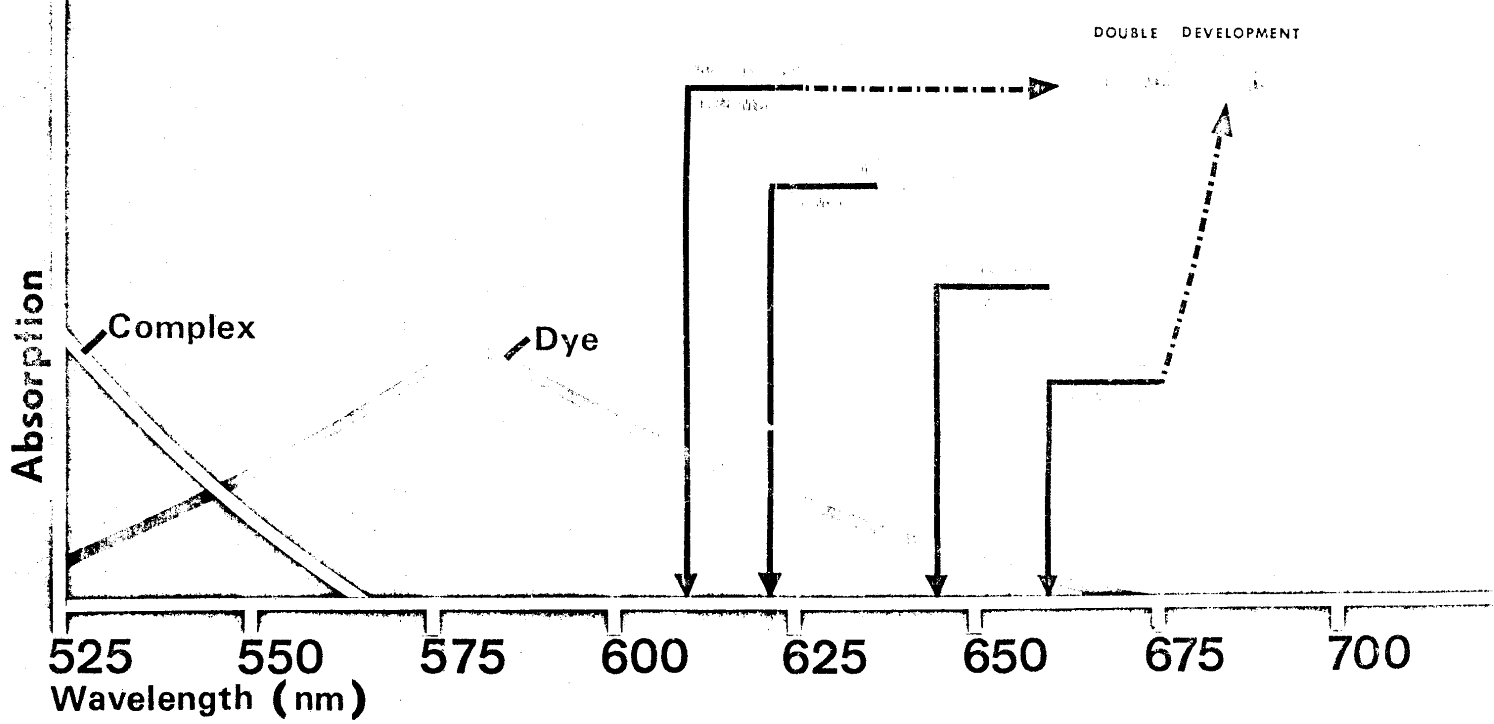
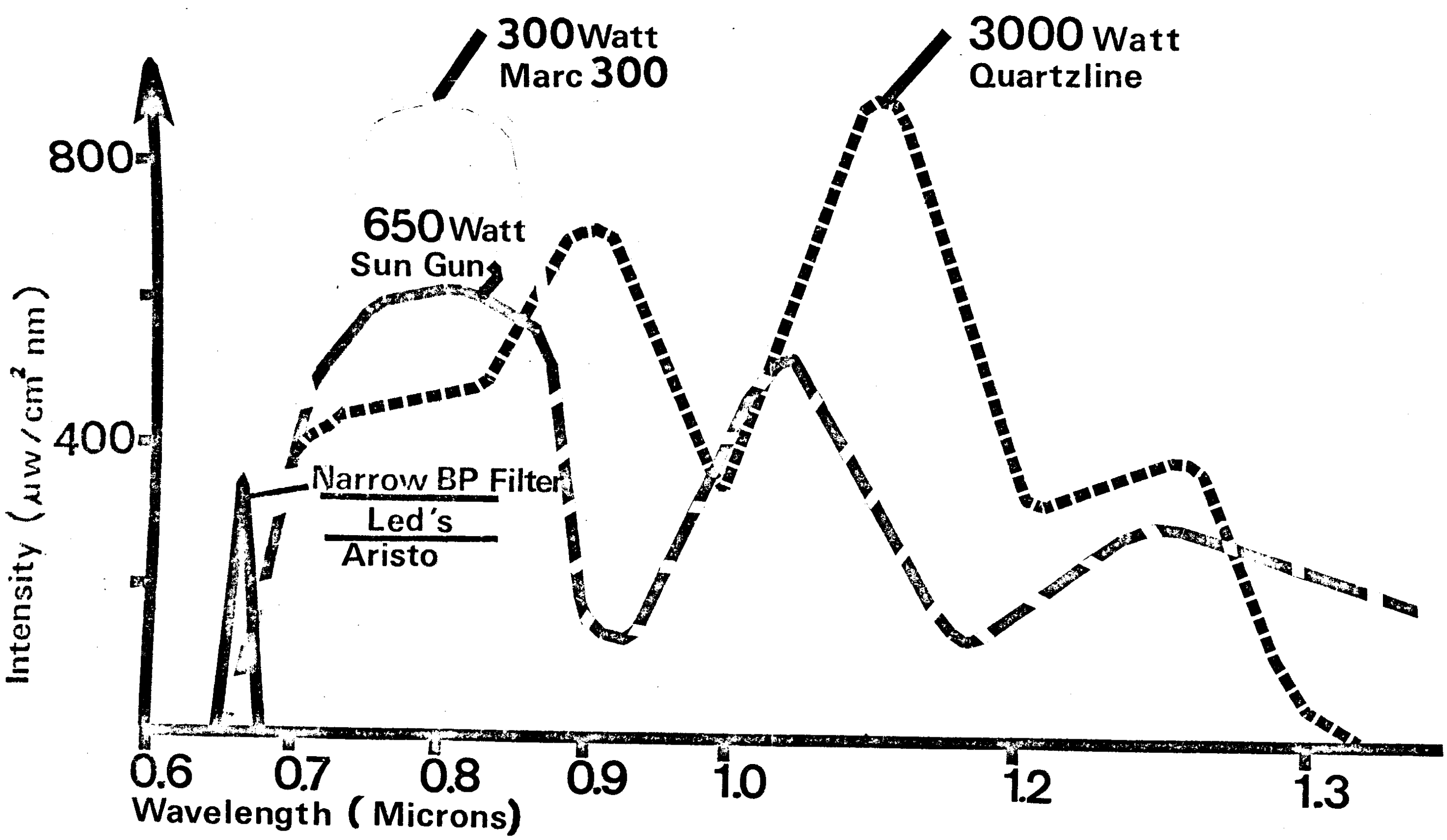
STYRYL DEVELOPMENT

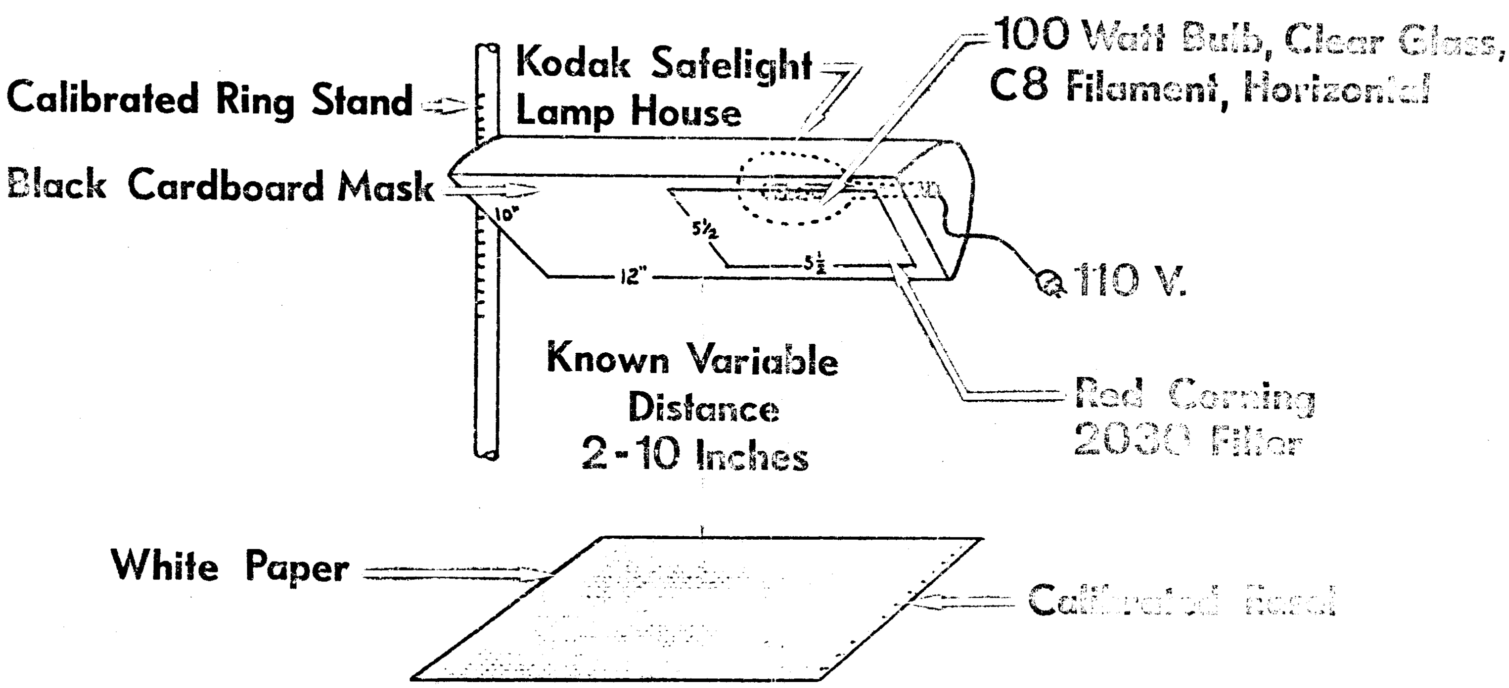
Effect of Development Radiation
Values obtained from laboratory samples



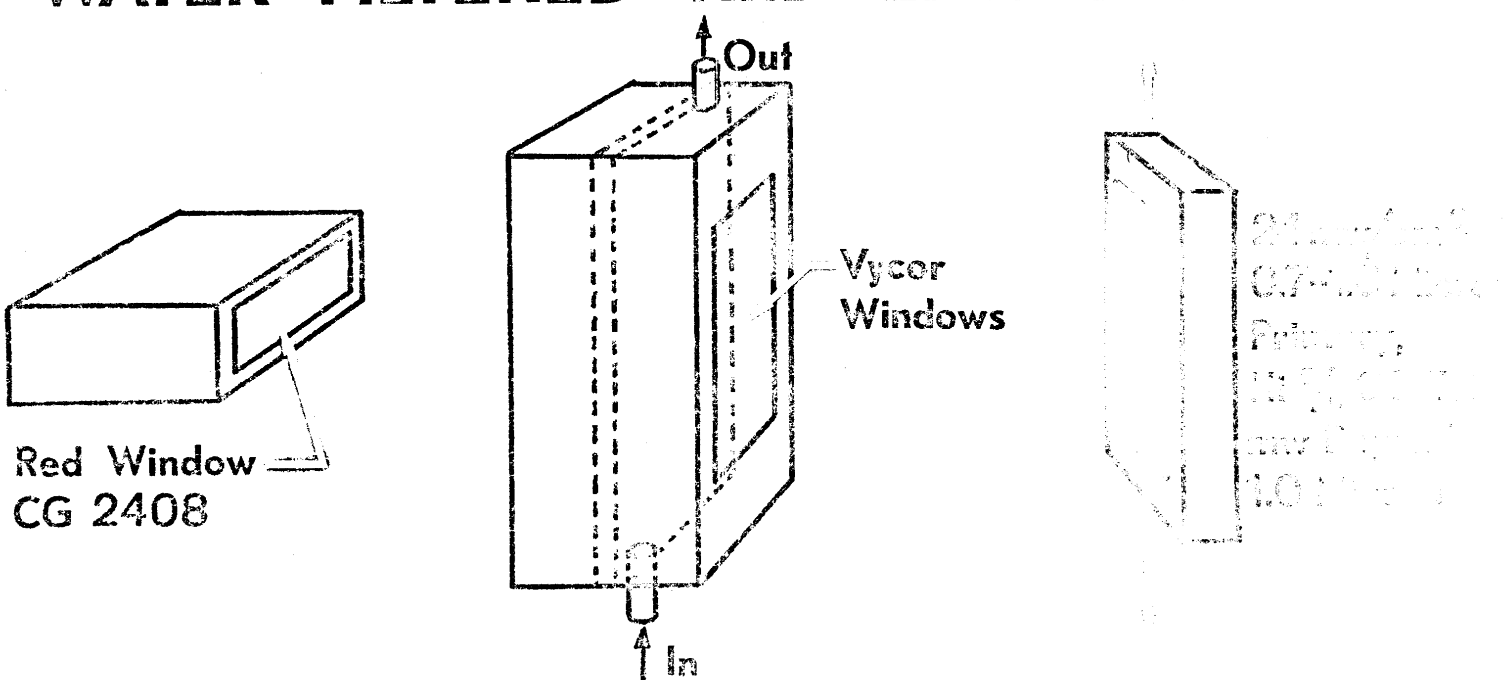
CG 2030 DEVELOPMENT LITE PROFILES



100 WATT TUNGSTEN UNIT



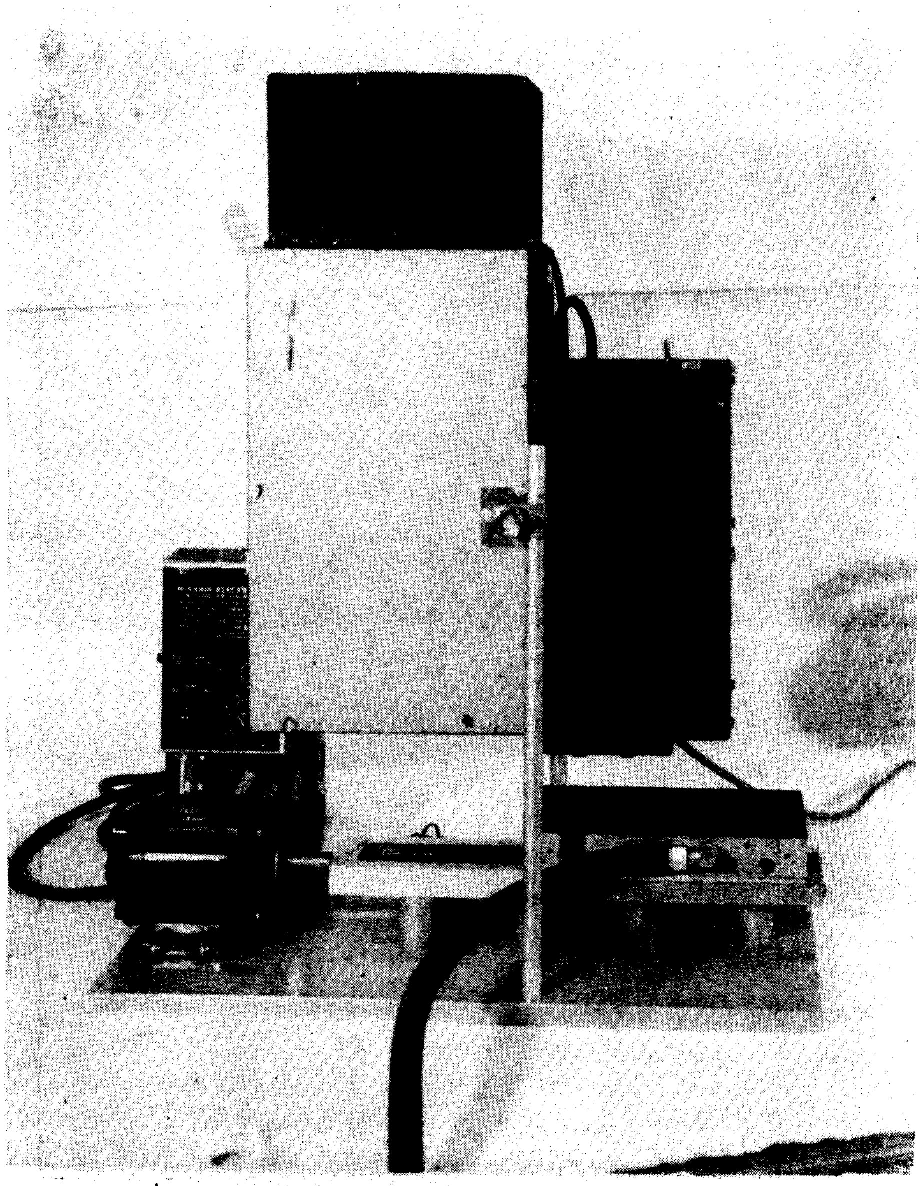
WATER FILTERED RED LITE UNIT



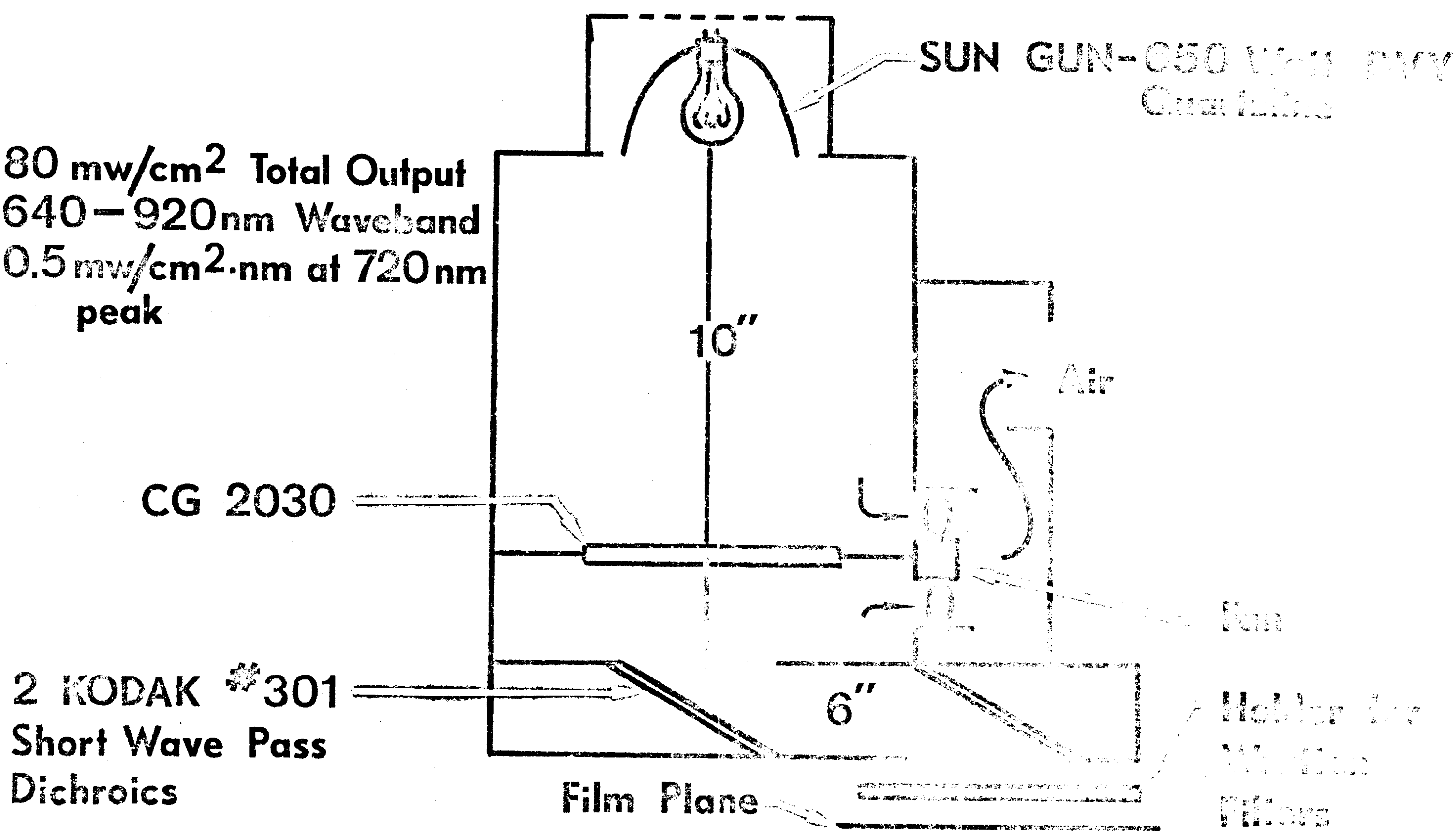
LAMP
1000 Watt Quartzline
3200° K Color

FILTER
2" Water Filter
CG2600 Mounted Internally

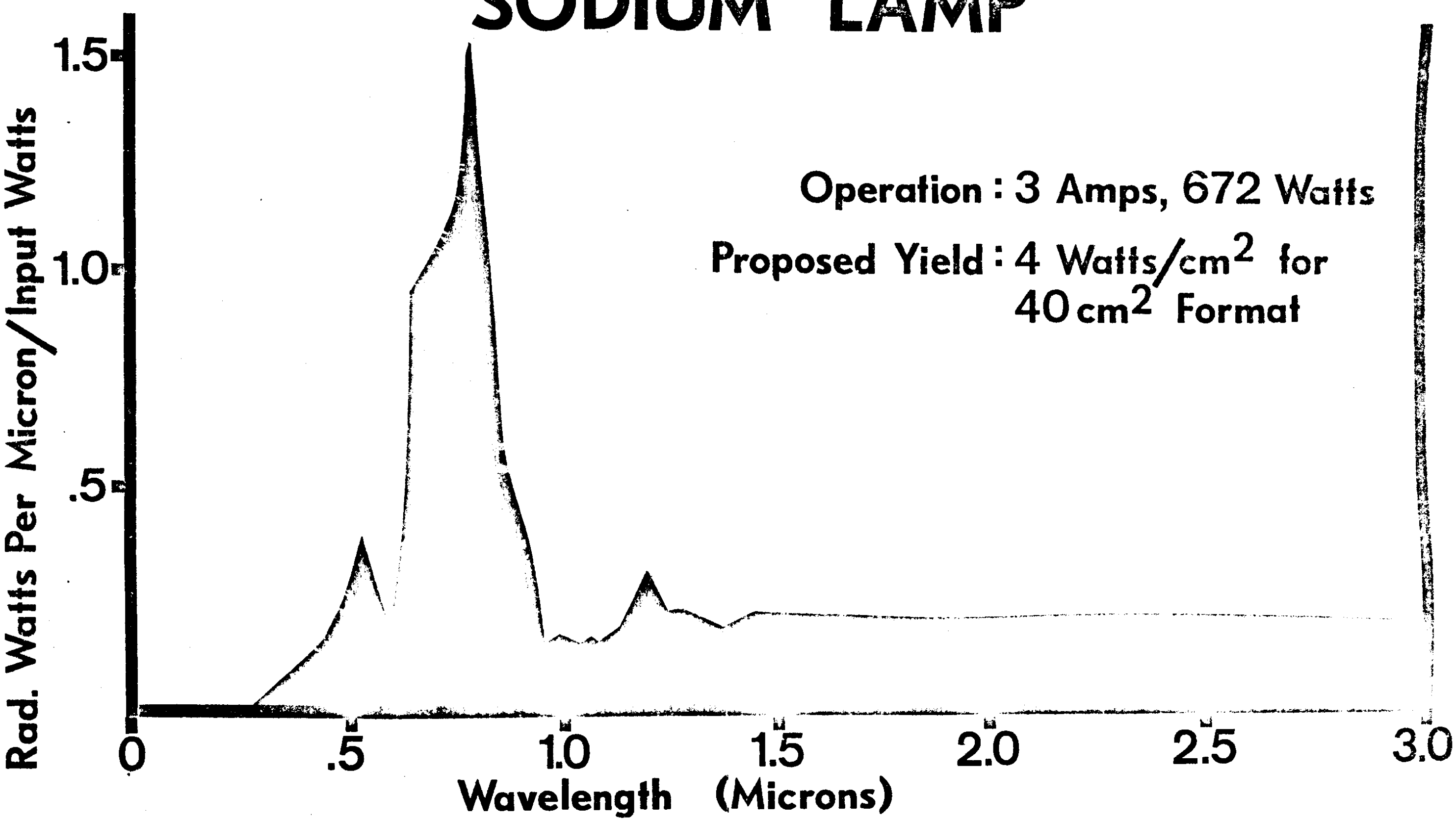
[illegible]
[illegible]
[illegible]
Vacuum Hold Down



DICHROIC UNIT #1



ELECTRO-OPTICAL SYSTEMS SODIUM LAMP



TYPE 2000 DUPLICATING FILM

25X1

25X1

[redacted] TYPE 2000 DUPLICATING FILMS 25X1

DRY PROCESSED

NON SILVER

VARIABLE GAMMA

NEGATIVE WORKING

HIGH RESOLUTION

DIRECT PRINT OUT

OPTICAL DEVELOPED

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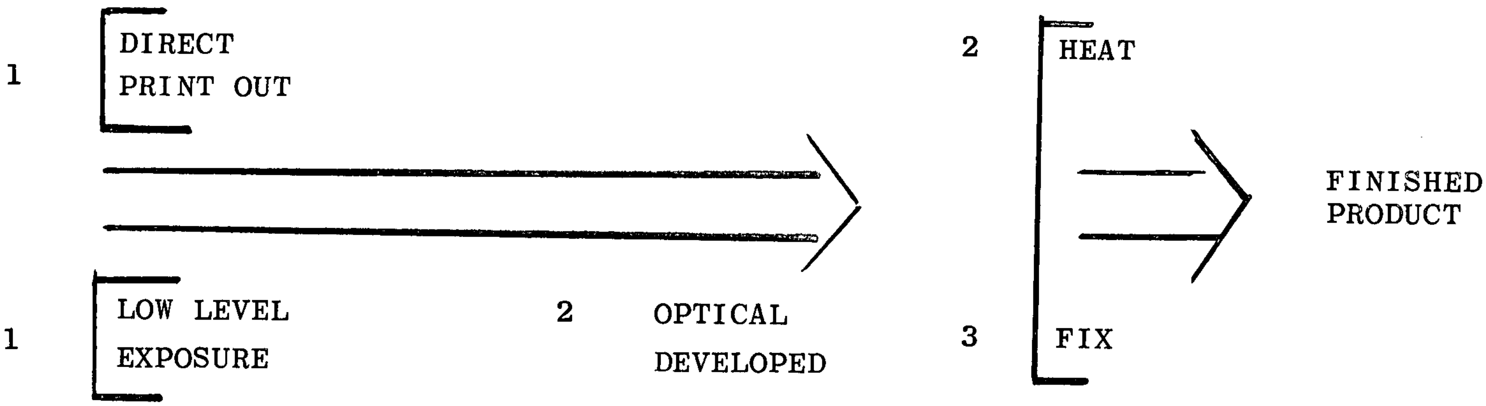
PROCESSING METHODS



AERIAL DUPLICATION FILM

DESIRED SPECIFICATIONS

(WHEN USED AS A MASTER POSITIVE PRINTED FROM THE ORIGINAL SILVER NEGATIVE)

VARIABLE GRADIENT	.85 to 2.0
BASE + FOG	.25 or LESS
USEFUL LOG e SCALE	VARIABLE
RESOLUTION (LOW CONTRAST)	$>$ 600 Lp/MM
DENSITY UNIFORMITY	$\pm 2.5\%$
IMAGE COLOR	BLUE
SENSITIVITY - EXPOSURE	$<$ 100 mj/cm2 to D=1.0 ABOVE BASE + FOG
SPECTRAL RESPONSE	360 to 550 nm
SHELF LIFE	1 Year at 40°F
BASE MATERIAL	POLYESTER-3 or 5 Mil, HEAT STABILIZED
PHYSICAL QUALITY	NO STREAKS, SCRATCHES, FOREIGN MATTER OR VOIDS

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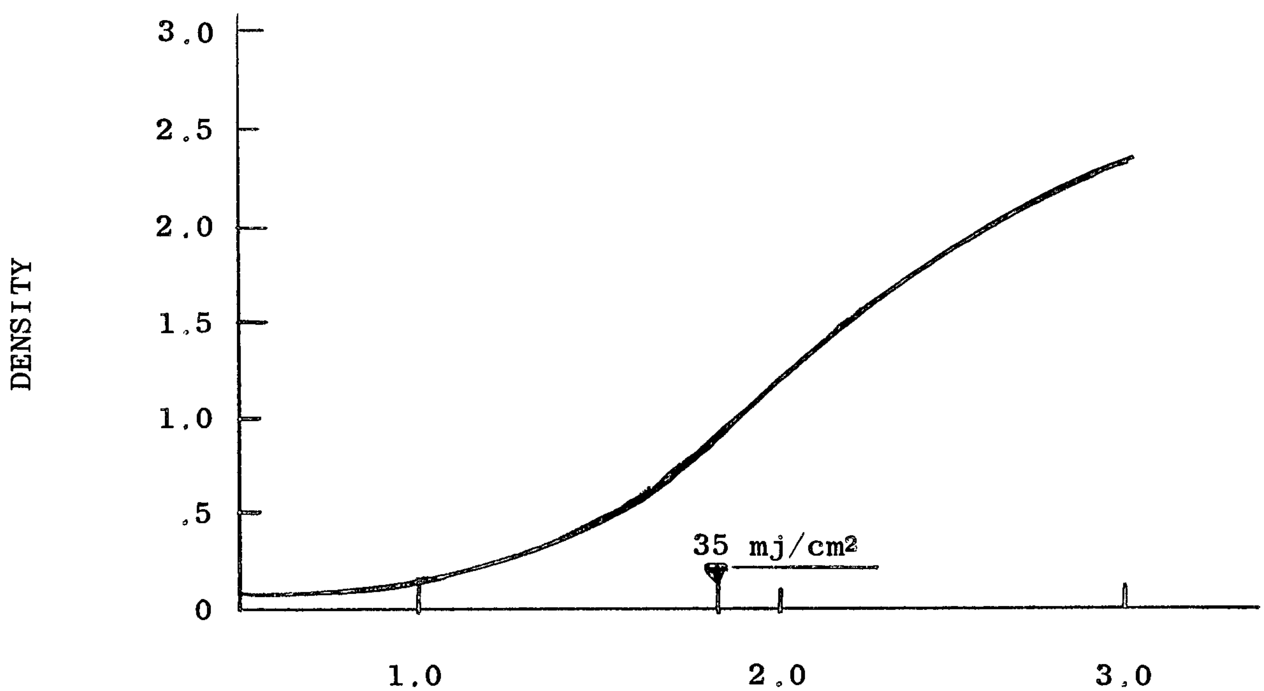
DIRECT PRINT OUT

d log e CURVE

NIAGARA WIDE FILM DUPLICATOR

(70MM CONVERSION) at 26' PER MINUTE



ABSOLUTE LOG E

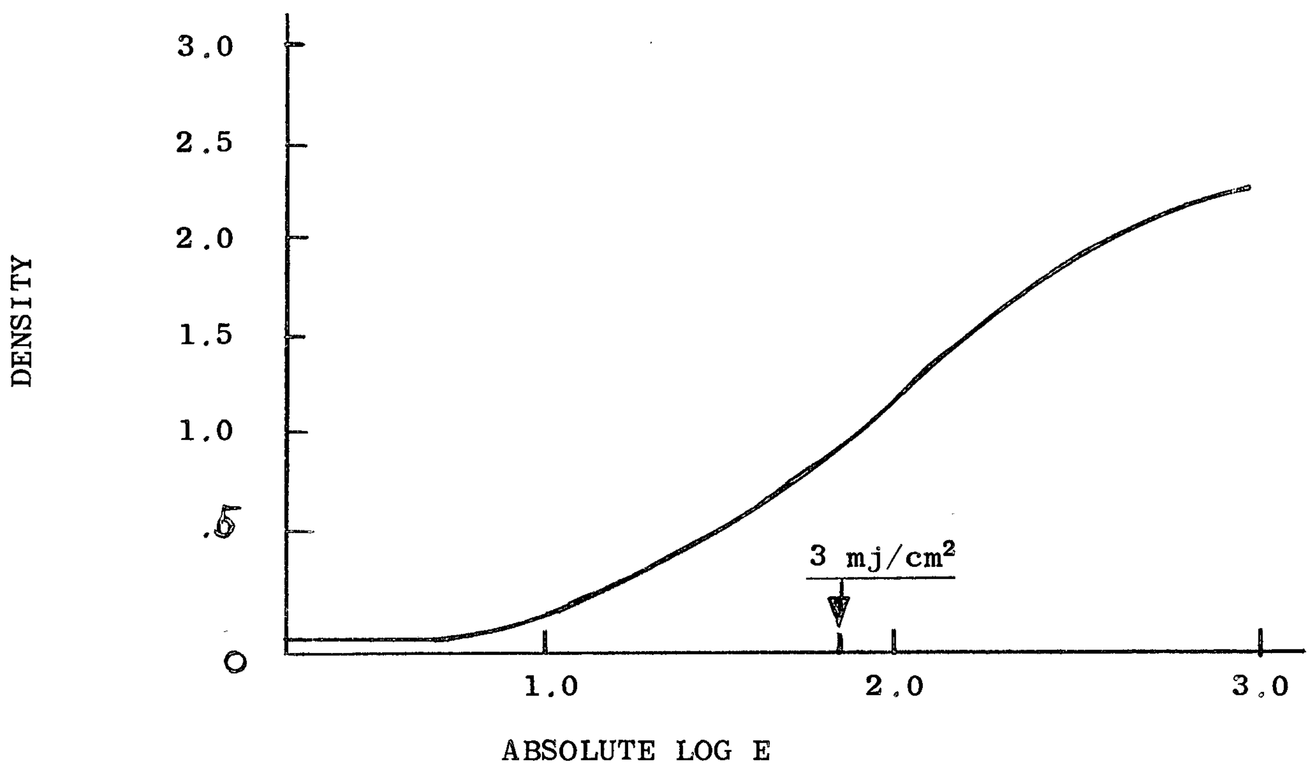
21 STEP EK No. 2 SILVER WEDGE   FIXED 170°C 90 SEC.

OPTICAL DEVELOPMENT

d log e CURVE

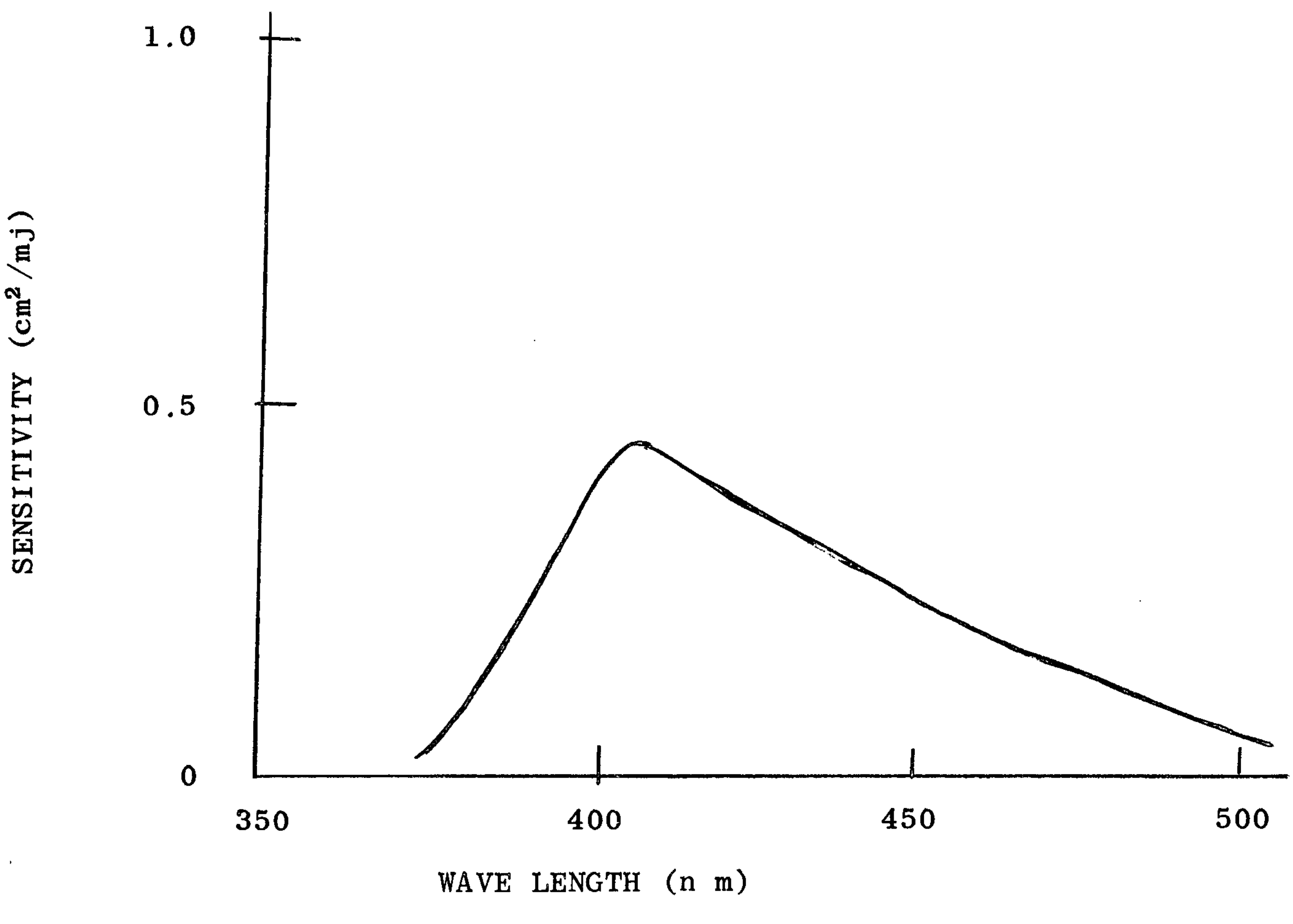
NIAGARA WIDE FILM DUPLICATOR

(70 MM CONVERSION) at 75' PER MINUTE



21 STEP NO. 2 SILVER WEDGE FIXED 170°C, 90 SEC.

SPECTRAL SENSITIVITY CURVE



GAMMA CONTROL

DIRECT PRINT OUT

VARYING FIXING TEMPERATURE AND/OR TIME PROVIDES GAMMA .85 - 2.0.

OPTICAL DEVELOPED

VARYING PLATEN TEMPERATURE DURING DEVELOPMENT PROVIDES GAMMA .85 - 2.0, ADDITIONAL GAMMA AVAILABLE DURING HEAT FIXING, IF DESIRED.

RESOLUTION

(STATIC CONTACT UNDER CONTROLLED CONDITIONS IN MILITARY SYSTEMS HIGH RESOLUTION TEST CAMERA)

$>$ 1500 CYCLES PER MM AFTER PROCESSING (DIRECT PRINT OUT AND HEAT FIXING).

STANDARD USAF 1951 $6\sqrt{2}$ RESOLVING POWER TEST TARGET, 228 CYCLES PER MM, HIGH CONTRAST: DENSITY DIFFERENCE 2.0, CONTRAST 100:1.

REDUCTION RATIO 20X.

WITH 1.6:1 CONTRAST TARGET
$>$ 900 CYCLES PER MM.

DYNAMIC RESOLUTION COMPARISONS

(70 MM MODIFIED NIAGARA) AT 10' PER MINUTE

WITH WESTOVER TARGET BELT (POSITIVE)

CALIBRATED BY [redacted] WITH A TOC OF 40:1 25X1

10' PER MINUTE
EASTMAN KODAK TYPE 2430 FILM PROCESSED DK 50 3 MINUTES AT 70°F HAND TRAY AVERAGE RESOLUTION.... 171 CYCLES/MM

[redacted] TYPE 2000 FILM............ 460 CYCLES/MM 25X1

5' PER MINUTE
EASTMAN KODAK TYPE 2430 FILM............ 410 CYCLES/MM

[redacted] TYPE 2000 FILM............ 646 CYCLES/MM 25X1

WITH A BACK COATING THE RESOLUTION OF [redacted] 25X1
TYPE 2000 FILM AT 5' PER MINUTE WENT TO 820 CYCLES/MM AT SAME CONTRAST.

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PHYSICAL CHARACTERISTICS

RECIPROCITY FAILURE

NONE OVER AN EXPOSURE RANGE FROM 10^{-8} TO 100 SECONDS.

IMAGE DECAY - NO FIXING

1/2 LIFE TESTING

INCREASED D_{MAX} AND GAMMA,
BASE FOG REMAINS ESSENTIALLY THE SAME
AFTER 9 MONTHS ROOM STORAGE.

STORAGE LIFE AND IMAGE STABILITY

PRE-EXPOSURE
- REFRIGERATED OVER 1 YEAR
- ROOM TEMPERATURE 9-12 MONTHS

AFTER FIXING, IMAGE PERMANENCE 30X DIAZO SYSTEMS.

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DYNAMIC SYSTEMS

PRESENT

16/35 CONTINUOUS HEAT FIXER

QC MODEL 104 OPTICAL PROCESSOR

NIAGARA 70 MM MODIFICATION KIT

3M HEAT PROCESSOR

PLANNED

9-1/2" CONTINUOUS HEAT FIXER

9-1/2" NIAGARA

FILM AVAILABILITY

(15" WEB EXPERIMENTAL COATER)

SINGLE SHIFT: 2,500,000 SQ. FT./YEAR

DOUBLE SHIFT: 5,000,000 SQ. FT./YEAR

ALL COATING IN CLASS 100 CLEAN ROOM

STANDARD ROLL SIZES: 16 MM, 35MM, 70MM
105 MM, 5 ", 6.6", 9.5"

PRICE PER SQ. FT. $3 (TEST ORDER MATERIAL)

STATUS

LIMITED PRODUCTION RUNS UNDERWAY

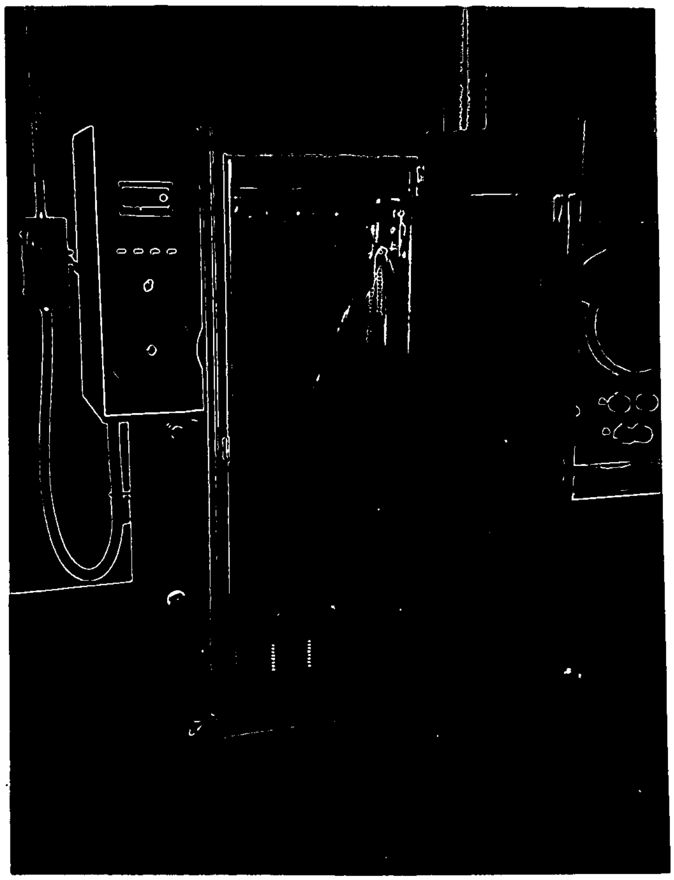
DELIVERIES BEING MADE ON MILITARY FILM CONTRACT

INITIAL DELIVERY MADE OF MODEL 104 QUALITY CONTROL OPTICAL PROCESSOR

PROTYPE OF 70MM NIAGARA MODIFICATION KIT COMPLETED

[redacted] 25X1

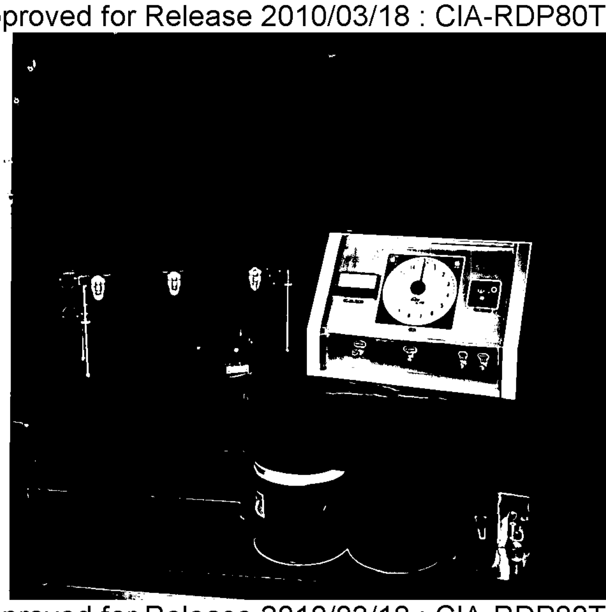
16/35 MM CONTINUOUS HEAT FIXER



25X1

70 MM NIAGARA MODIFICATION KIT

25X1



HID-2 RED-LITE DEVELOPMENT UNIT

From 17 MAR '82

25X1

25X1

[redacted] DEVELOPMENT UNIT

HID-2

I Light Source - Marc 300 Arc Discharge Lp

A. Format 1-1/4"x 1-1/2" to 2" x 2" adjustable

B. High uniformity - measured at $\underline{+}1\%$

C. Low wattage - high intensity, RG670 approximately 15 mw/cm^2

D. Comparatively long life - 25 to 50 hours, depending on cycle time

E. Unchanging color temperature with wattage variation

F. Simple configuration

G. Lower I with V variations than are common with tungsten lamps

H. Lamp may be burned continually

I. Automatic Shutter - turned on and off by logic circuit

J. Many different lamp-reflector combinations possible

K. Internal dichroic and external holder for additional filters - remove IR and vary spectral output for all film systems

II Platen - Black Anodized Surface - Stationary Development

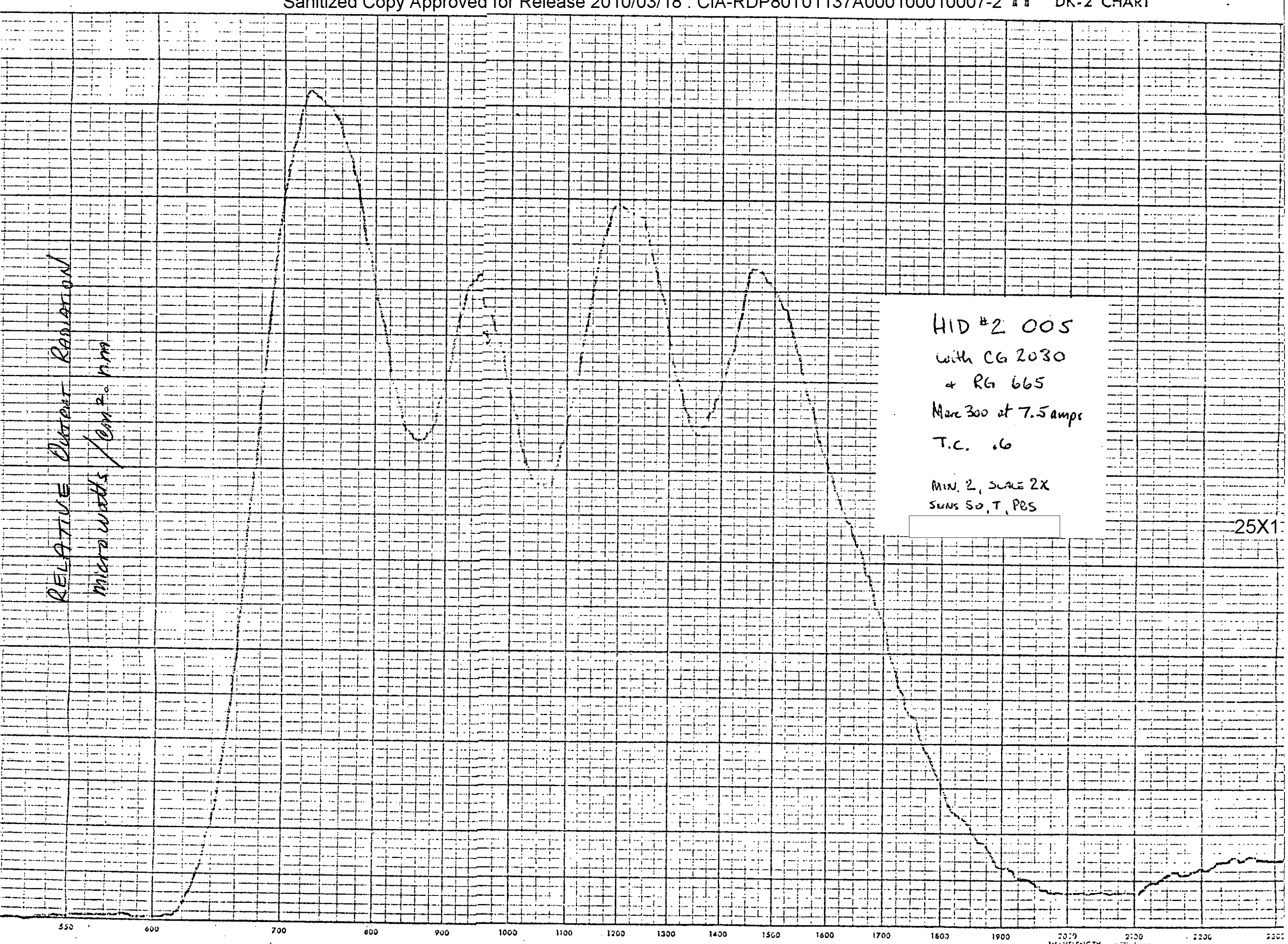
A. Pin-registry of sample assures precise location

B. Vacuum channel hold down - 2-1/4" x 2-1/2" vacuum channel - minimum sample size excluding pins

[redacted] 25X1

WHEN REORDERING SPECIFY CHART NO. 12978 BECKMAN INSTRUMENTS, INC. U.S.A.

DK-2 CHART



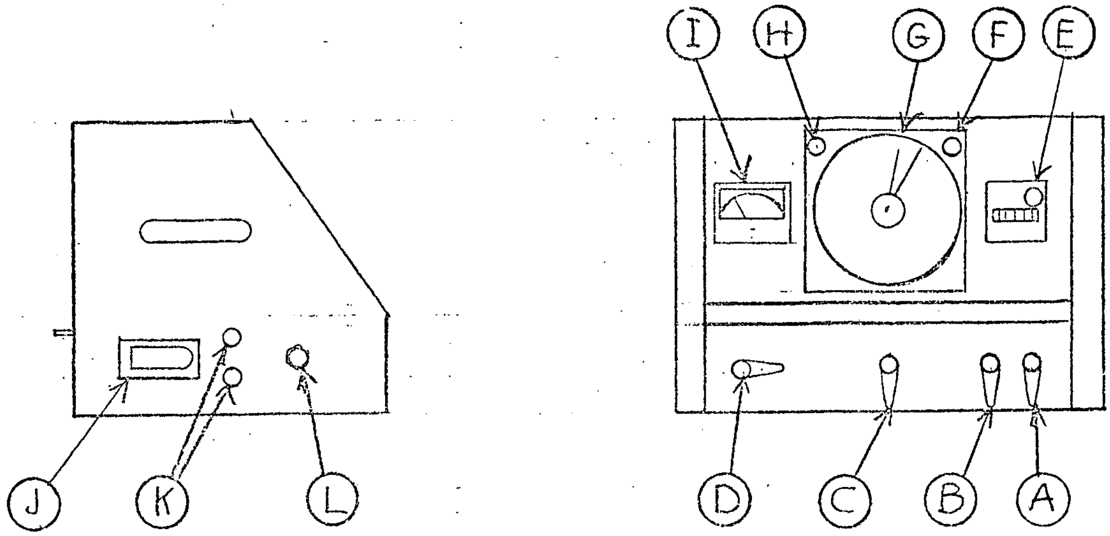
25X1

25X1

RED LIGHT FILM PROCESSOR

HID-2

POWER SUPPLY COMPONENT PLACEMENT AND FUNCTION



A. Power Switch - The entire unit is OFF when the switch is off. Turning the switch ON automatically turns on the cooling fan in the lamp housing unit.

B. Lamp Switch - This switch controls the lamp. The lamp should remain on a minimum of three minutes before being turned off to prevent damage to the lamp.

C. Buzzer - In the ON position, the exposure timer will give an audible signal when a preset timer has elapsed.

D. Vacuum Pump Switch - This switch controls a combination vacuum pump and compressor housed in the power supply. The vacuum fitting is designated as "L" as on the schematic layout of the unit; the pressure fitting is on the back of the unit.

Gauges indicating both vacuum and pressure can be read by opening the top cover of the power supply. Adjustments to limit both vacuum and pressure can be made by removing the top front panel.

WARNING! <u>When making adjustments on the pump, be sure the lamp switch is OFF and be very careful not to touch any electrical connectors or components</u>.

E. Lamp Life Resettable Timer - used to determine the usable remaining life span of the lamp. The rated life of the Marc 300/35K lamp is 25 hours. Under no conditions should it be used for more than 50 hours. To reset the zero each time a lamp is replaced, turn the knob to the right of the numbers clockwise.

F,G,H. Exposure Timer - With switch "H" in the closed position, the shutter is operated by the timer. Turning the large hand clockwise will set the number of minutes; Knob "G" seconds. Switch "F" activates the timer and opens the shutter simultaneously.

I. Ammeter - displays relative lamp current. Should be set according to calibration data supplied with each lamp.

To set, turn lamp on, wait a minimum of three minutes and adjust transformer inside power supply accessable by opening the top cover.

J. Receptacle - receives power cord from lamp housing unit.

K. Fuses - Buss A B C 15 250V 15A

L. Vacuum Fitting - for vacuum hose from platen.

To Operate

Plug cord from power supply into any 115V 60HZ source. Be sure power switch "A" is OFF.

Connect vacuum fitting on power supply "L" to fitting on platen with tubing.

Insert power cord from lamp housing unit into receptable in power supply "J".

Install filters in places provided below the shutter.

With switch "H" in the closed position, switch "F" off, vacuum pump "D" off, buzzer "C" off, lamp switch "B" off, turn power switch "A" on. This should start the fan in the lamp housing unit.

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Turn lamp switch "B" on. Wait a minimum of three minutes before using the unit.

This unit can process 2-1/2" x 2-1/2" strips of [redacted] 25X1
films.

Pull platen towards you and place film over the vacuum channel and register pins. Turn vacuum switch "D" on. Push platen forward until it stops.

Preset exposure time by turning the large hand (for minute) and the knob "G" clockwise to the desired setting. Turn switch "F" on. The shuuter will open and then close automatically after the preset time has elapsed.

If desired, turning the buzzer switch "C" on will give an audible signal when the timed period ends.

To Change Lamps

Be sure power switch is off and the lamp housing unit has had sufficient time to cool down.

Remove cover from lamp housing unit.

Remove wire attached to the lamp from the terminal block.

Remove lamp mount lock by pulling it back, towards the fan, it can be pivoted upwards if desired. The lamp can now be removed.

Insert new lamp into mount and lock in place.

Put wire from lamp into terminal block.

Replace cover.

Turn lamp life resettable timer "E" to zero.

Start lamp, wait three minutes and adjust current according to calibration data supplied with each lamp.

HID-2

LAMP HOUSING UNIT

Several precautions should be taken when working on the lamp housing unit.

1. Do not use the air inlet as a handle when removing the cover as this will promote light leaks.

2. Do not put hands, screwdrivers, etc., into the unit while the power switch is on, as dangerous voltages are present.

3. The dichroic mirror is installed with the coated side facing the lamp.

4. Do not touch the lamp with your fingers, as the oils from your skin will cause devitrification of the quartz. Isopropyl alcohol should be used to clean the lamp. The lamp mount should be kept clean and free from lint, etc. as this dirt will cause arcing and damage to the power supply.

5. When replacing the lamp housing cover, do not lean on it; instead, squeeze against the bottom of the unit.

6. Height adjustments are made by measuring from the platen to the underside of the unit (not the insulation).

7. Be sure there is at least one foot of clear area behind the exhaust fan (cage) to allow for cooling air circulation.